

522  
Coordinated Investigation of  
Micronesian Anthropology  
1947-1949

Anthropological Study of the Ponape Islanders  
FINAL REPORT of Rupert I. Murrill

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## FOREWORD

I would like to thank the Pacific Science Board, American Museum of Natural History, and the United States Navy in general, for having made possible my work on Ponape.

The entire Navy personnel on Ponape was responsible for making my visit there both pleasant and comfortable. In particular I wish to thank Lt. Halvorsen for facilitating my contacts with the natives, Lt. Anderson for arranging my food supplies, and Lt. Mitchell for transportation.

Regarding this final report especial thanks are due to Andreas, my interpreter, without whose aid much of my work would have been impossible; to Dr. C. W. Dupertuis, for instructing me in the posing of subjects for somatotype photographs; and last, but not least, to Dr. H. L. Shapiro, for invaluable advice throughout this study.

POPULATION, PHYSICAL CHARACTERISTICS, AND CONSTITUTIONAL  
TYPOLOGY OF PONAPE ISLANDERS, EASTERN CAROLINES

ALBERT H. MCKILLIL

In the summer of 1947, as a member of the project entitled the "Co-ordinated Investigation of Micronesian Anthropology" (C.I.M.A.), I was delegated to study the physical characteristics of the natives of Ponape Island.

Ponape is a high coral island in the Eastern Carolines, approximately 350 miles east of Truk, 300 miles south-east of Guam, 560 miles from Honolulu and 200 miles from Manila. The island is about 1,0145 square miles in size, with mountains in the interior rising to 2500 feet. Between the coast line and the foot of the mountains, the land is mostly flat, and it is here that the natives live. It is divided into 5 Districts - Sokes, Net, U, Matolenia, and Mitti. The Districts are divided into Sections and these into farmsteads. The climate shows an annual average temperature of 80° F., humidity of 86%, and rain-fall around 180 in.

Ponape has had many contacts with foreigners. During the years 1826 to 1846 American whaling ships visited the island, especially in the 1840's. By the 1870's there were on Ponape trading stations of three German firms, which were combined in 1887 to form the Jaluit Company. From 1886 to 1890 the island was held by the Spanish who brought in some Philippine soldiers. Between 1890 and 1914 it was a German possession. The Germans are said to have introduced a few New Guinea workmen. By 1893 the Japanese firms were trading on Ponape, and in 1900 these firms combined to form Nampo, or the South Seas Trading Company. In 1911 the German Governor was killed in the 'Sokes rebellion', due to which the Sokes inhabitants were deported to Palau in the Western Carolines. In 1919, after a typhoon had caused severe damage in several

islands in the Carolines, about 1850 'outislanders' were brought to Ponape and settled in Dolas. This was the last native immigration to Ponape of any considerable size. During the Spanish and German periods the number of whites on the island was continually small. From 1914 to 1945 Ponape belonged to the Japanese, who heavily colonized the island. They returned to Ponape from Palau the remaining deported Dolas inhabitants. In 1945 the Japanese and Korean population of 14,000 (Army, Navy and Civilian) was removed by Americans, who now hold the island under a trusteeship.

As is to be expected from the above short history the population on Ponape is today a varied one. To day, however, conveniently divide the native population into the main types: (1) 'Pure' Ponapeans - that is to say, those whose ancestry shows no mixture with whites. (2) 'Mixed'. These can be sub-divided into: a. Ponapean natives who mixed with whites, such as German, English, French, Germans, and Portuguese. b. Ponapean natives who mixed with 'outislanders', natives from surrounding islands. c. Ponapean natives who mixed with the Japanese. d. Various combinations of a, b and c.

My main concern was to make an anthropometric study of the 'Pure' Ponapean type. This could only be accomplished in one way, namely by first tracing the genealogy of each person measured, to at least the second-parent generation on both the father's and mother's side, so as to be as sure as is possible, within the bounds of memory, that the individual was not one of the 'Mixed' type. As there was invariably present during the questioning both old men and women who served as a reference committee regarding the individual's ancestry, this provided a constant check to statements made by the natives. I have every reason

to believe these statements as there was no feeling of disgrace in being of mixed parentage. In taking these genealogies I was also able to obtain the information concerning vital statistics used in the following section.

POPULATION

Most of the Japanese vital statistics such as birth, death, and infant mortality rates, age and sex composition, are given under the heading of the Ponape French Bureau, which was the Japanese Administrative District for the Eastern Carolines. This French Bureau included besides Ponape such islands as Greenrich (Taping Marngi), Mokil, Ngatik, Hussie, etc; therefore one cannot apply the above vital statistics to Ponape alone.

For this reason, although not knowing the total number of native births and deaths on Ponape during 1946-47, due to faulty or non-registration of same, I have had to rely mostly on the 1947 total native population census, and whatever additional information I could obtain from the natives. Table 1 shows the official censuses taken of the total native population.

TABLE 1

Year	No	Administrative power
1920	1165	Japanese
1930	5290	"
1940	5328	"
1947	5055	American

Only those censuses considered reliable have been used, due consideration being given to the counting of immigration and emigration.

Between the years 1920 and 1940 there was a total gain of 40.8 per cent. However, between 1930 and 1940 the gain was 27.7 per cent, between 1930 and 1940 only 10.0 per cent, and between 1940 and 1947 there has been a decrease in the population.

There is an indication that this recent decrease is due to a decrease in the birth rate. Information was obtained from a representative sample of 162 women, covering the five Districts of Ponape. That this sample was representative is shown by the fact there were 56 children ages 0-4 years for 162 women ages 15-44, which gives for 1600 of these women 451.1 children. The 1947 census (table 5) shows 695 children ages 0-4 years for 1554 women ages 15-44, giving for 1600 of these women 461.0 children. The results of the younger age groups, in the sample of 162 women, are given below in table 2.

TABLE 2

Present Age	No	Age in years at marriage	Average no of live births in first 5 yrs. of marriage	Approximate Year Span
30-39	54	17.5	1.5	1930-39
20-29*	41	17.0	1.2	1940-47

\* In this group all women 20-29 years of age had been married 5 years or more.

This indicates that the younger women are having fewer children in the first five years of marriage, especially the youngest, since of women ages 20-29 there were 18, ages 30-39, who had a total of 11 children in the first five years of marriage, or an average of only 0.6 children.

This can also be shown in another way. From the sample of 162 women the following age-specific birth rates were obtained (table 3).

TABLE 3

Period	Total <sup>1</sup>	Age of mother						
		20-24 <sup>2</sup>	25-29 <sup>2</sup>	30-34 <sup>2</sup>	35-39 <sup>2</sup>	40-44 <sup>2</sup>	45-49 <sup>2</sup>	50+ <sup>2</sup>
June 1946- June 1947	76.4	111.1	136.7	85.7	47.6	--	--	--

1. Births per 1000 females 15-54 years of age.
2. Births per 1000 females of that age group.

The above rates must be used with caution since they are based only on a sample of the population. However, it can been seen that the age-specific birth rate for the 25-29 year age group is higher than that of the 20-24 year age group, even though the mean age at marriage for 162 women was 17.0 years, and although from a sub-sample of 162 women 20 years of age and over only 2 or 1.6 per cent were unmarried.

Shapiro\* has mentioned Sundbarg's observations on populations as follows, "He was the first to notice that about 50 per cent of the total of most populations fall within the 15-40 year age class, an age division responsible for practically all of the reproduction of a population, and that the proportion of the total included in the pre-reproductive, or 0-14 year group, fluctuated inversely with the percentage in the post-reproductive group comprising those 50 years and over in age. Furthermore, Sundbarg reported that the reproductive vigor of a population was correlated with the proportion of the pre-reproductive group to the total."

Sundbarg's terms for the various proportions in a population, quoted by Pearl,<sup>†</sup> are shown in table 4.

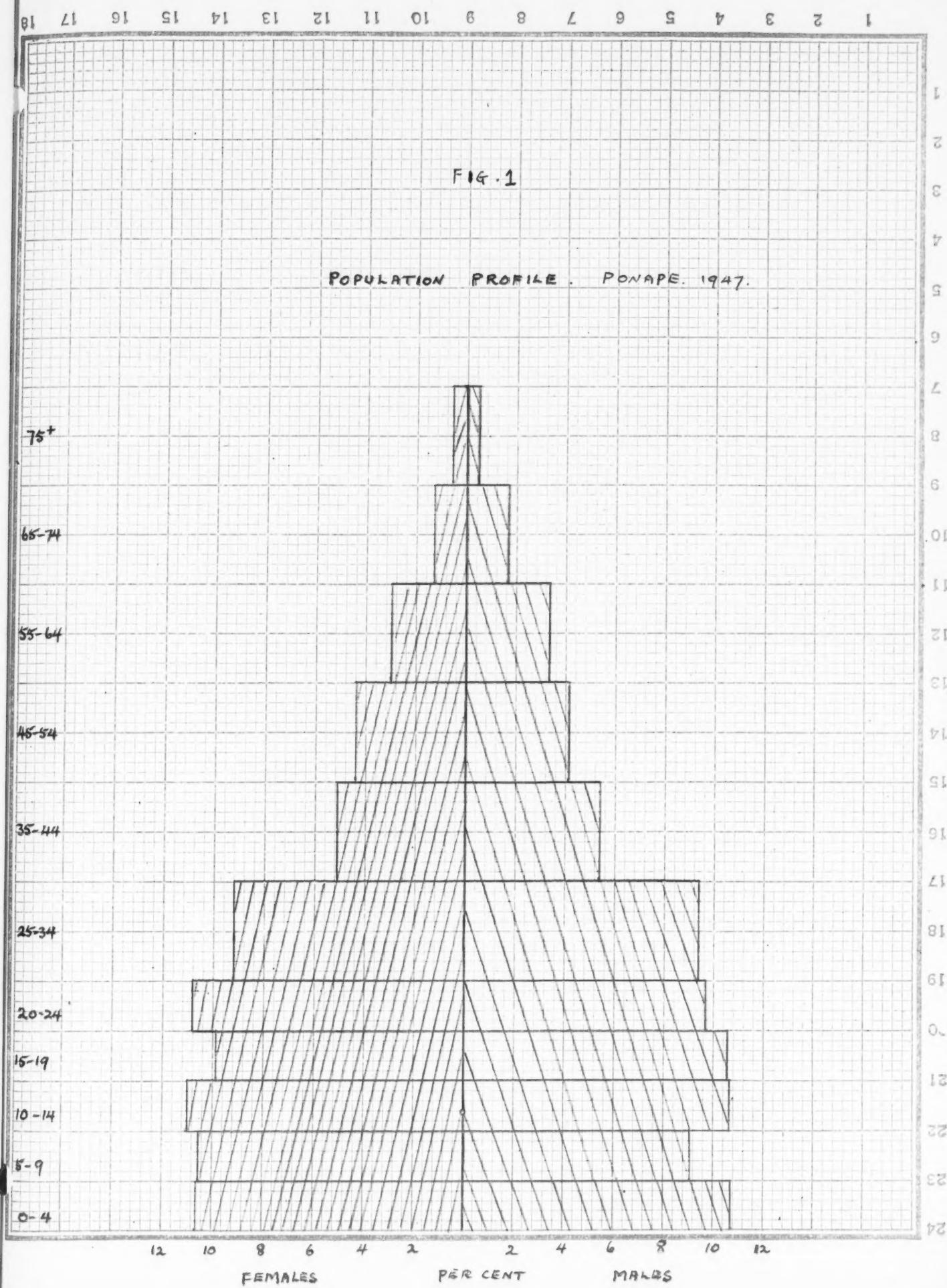
TABLE 4

Terms	Pre-reproductive Group 0-14 yrs %	Reproductive Group 15-40 yrs %	Post-reproductive Group 50 yrs and over %
'Progressive'	40	50	10
'Stagnant'	33	50	17
'Regressive'	20	50	30

Sundbarg's data also show that the pre-reproductive group varies in proportion to the total from 22.2 per cent in Sweden to 42.7 per cent in Brazil.

\* ('42)

† ('40)



The 1947 Ponape census is given in table 5a.

TABLE 5a

TOTAL NATIVE POPULATION

Age group	Male	Female	Total
Under 1 yr	30	74	164
1 yr	45	25	70
2 "	71	56	127
3 "	68	66	134
4 "	53	71	124
5-9	234	203	575
10-14	330	306	636
15-19	325	273	598
20-24	298	298	596
25-34	583	506	1089
35-44	358	377	615
45-54	256	238	494
55-64	214	163	377
65-74	112	74	186
75 & over	36	61	97
Totals	3108	2747	5855

The number of individuals, both sexes, in the 0-14 year group is 1634 or 28.1 per cent of the total population. Assuming that the 15-49 year group is 50 per cent, then we have 18.7 per cent in the 50 year and over, or post-reproductive group. With 21.2 per cent of its population in the pre-reproductive group, Ponape falls into Sundbärg's 'stagnant' type of population, and mid-way between the extremes of Sweden and Brazil. In other words, the Ponape population is neither in an increasing nor decreasing phase of growth.

Table 5b shows the percentage calculations from which the population profile of Ponape has been constructed.

TABLE 5 G

Age group years	No	Female %	No	Males %
0-4	232	10.6	232	10.7
5-9	233	10.5	234	10.1
10-14	233	11.1	230	10.6
15-19	273	9.9	235	10.5
20-24	233	10.6	232	10.7
25-29	253	9.9	232	10.4
30-34	153	5.1	132	5.4
35-39	113	4.2	120	4.1
40-44	62	2.6	107	3.4
45-49	37	1.3	52	1.8
50 & over	16	0.6	15	0.5

In the 10 year age groups half the number of males and females in the census are used in the percentage calculations, to be consistent with the 5 year age groups

The population profile (Fig. 1) summarizes the population picture of female and by its very shape, with approximately parallel sides up to the 35-39 year age groups, presents a population probably on the way to a decline.

For those who might wish to study the Ronape population in the future, table 6 is a summary of the fertility of those women 45 years and over, namely those who have finished their reproductive period of life, taken from the sample of 167 women.

TABLE 6

No. of women ages 45-59	No. of live births		No. of survivors		No. of children born that died	No. of mis- carriages	No. of still births
	Male	Female	Male	Female			
32	38	54	56	57	57	90	1
Average	1.18	1.63	1.75	1.63	1.73	0.67	0.06

This shows an average per mother of 5.6 children born alive, with approximately an average of 4 children surviving. Of the 57 children who died, 35 were 1 year or less in age, or 61.4 percent. Of these 35 children, 21 were males and 14 females, indicating that the infant mortality was high, especially among males.

Finally, the average number of miscarriages was 0.6, but of the 72 women this miscarriages occurred in 10 women, of which 1 woman had 6 miscarriages. Only 1 stillbirth was recorded.

SAMPLE

Every Ponapean belongs to one of a number of exogamous matrilineal clans, furthermore the society was a stratified one according to rank. There were those having two noble parents, those having only one noble parent, and commoners with no noble blood. Actually, commoners could achieve higher status by becoming stewards to chiefs, or by marrying a noble, or becoming a Section Chief. Bascom\* states that "It is possible that in earlier times the boundaries of the three groups may have been more clearly defined than at present. .... It may be more accurate to picture rank in Ponape, except perhaps among the commoners, in terms of more or less of a continuum, within which the individual's position depended on both his hereditary and achieved status, rather than in terms of discrete and clearly separated hereditary classes whose relative position determined the rank of all their members."

Since the natives live in separate farmsteads, distances were too great to visit each house individually. The local District Police Chief was therefore instructed to summon the men and women to the District meeting house, from about every third or fourth home. This was done in each of the five Districts. Great stress was laid on the fact that individuals were not to be from the same family, and that they have to be from as many different clans as possible. All this was checked in the subsequent interview. One can say then that the sample is as random as one as could be obtained under the above circumstances.

By this method I obtained 100 males, ages 20-60, and 127 females, ages 16-60, giving a total of 227 male and female adults. The nature

\*. Bascom, W. A. Ponape: A Pacific Economy in Transition. U.S. Commercial Company, p. 56, 1946.

of this data does not lend itself to testing any significant physical differences that might exist between the different social classes. I have estimated that there are 2,000 adults, males ages 20-60, and females ages 18-60, in the total native population. Of this 2,000, approximately 300 are out-islanders, and 170 known mixed bloods, many of the latter belonging to same families. This leaves a total of 1,628 'Pure' Fijians, of which the sample of 257 represents about 1/6th. The age distribution of the males and females in the sample is given in table 7.

TABLE 7

Age	No.	Males %	Age	No.	Females %
20-29	83	35.32	10-19	5	3.94
30-39	86	37.63	20-29	35	27.56
40-49	35	14.32	10-19	58	46.32
50-59	23	17.62	40-49	32	25.82
60-69	8	9.51	50-59	14	11.02
			60-69	8	2.56

TABLE 8

Statistical Constants of 130 Male Ponape Islanders

<u>Measurements</u>				
	<u>Range</u>	<u>Mean</u>	<u>S</u>	<u>V</u>
Weight	92-171 lbs	130.27±.91	15.43±.65	11.84±.50
	cm	cm	cm	
Span	150-187	167.95±.45	7.57±.32	4.51±.19
Stature	149-180	163.21±.36	6.00±.25	3.68±.15
Porion	137-167	151.26±.35	5.95±.25	3.93±.16
Head Height	9-14	11.79±.04	0.73±.03	6.19±.26
Acromion	122-150	134.35±.33	5.51±.23	4.10±.17
Radiale	92-114	102.68±.25	4.30±.18	4.19±.18
Stylium	67-86	77.78±.21	3.55±.15	4.56±.19
Dactylion	47-66	60.02±.17	2.91±.12	4.85±.20
Tibiale	36-49	42.81±.16	2.71±.11	6.33±.26
Sphyrion	4-8	6.53±.04	0.64±.03	9.80±.41
Sitting Height	76-95	86.00±.18	2.99±.13	3.48±.15
Trunk Height	47-60	54.95±.14	2.39±.10	4.35±.18
Arm Length	66-85	74.38±.21	3.60±.15	4.84±.20
Leg Length	68-87	77.17±.24	4.05±.17	5.25±.22
Biacromial	32-41	36.60±.09	1.60±.07	4.37±.18
Chest Width	22-30	26.07±.08	1.33±.06	5.10±.21
Chest Depth	17-24	20.51±.07	1.17±.05	5.70±.24
Chest Girth	70-94	81.00±.22	3.66±.15	4.52±.19
Hip Width	23-31	27.23±.08	1.33±.06	4.88±.20
	mm	mm	mm	
Head Length	177-213	191.98±.36	6.12±.26	3.19±.13
Head Width	131-155	141.88±.24	4.14±.17	2.92±.12
Minimum				
Frontal	92-110	100.55±.21	3.53±.15	3.51±.15
Bizygomatic	123-145	135.16±.26	4.44±.19	3.28±.14
Bigonial	93-118	104.65±.29	4.82±.20	4.61±.19
Total Face				
Height	102-139	122.64±.40	6.82±.29	5.56±.23
Upper Face				
Height	56-87	72.72±.33	5.52±.23	7.59±.32
Nose Height	48-67	57.16±.24	3.97±.17	6.95±.29
Nose Width	36-49	42.36±.15	2.50±.10	5.90±.25
<u>Indices</u>				
Relative Span	96-110	102.88±.14	2.28±.10	2.22±.09
Relative Shoulder Width	20-25	22.39±.05	0.77±.03	3.44±.14
Relative Hip Width	14-19	16.71±.05	0.80±.03	4.79±.20
Shoulder-Hip	63-82	74.61±.22	3.66±.15	4.91±.21

TABLE 8 (cont)

	<u>Range</u>	<u>Mean</u>	<u><math>\sigma</math></u>	<u>V</u>
Relative Sitting Height	49-56	52.76 $\pm$ .07	1.20 $\pm$ .05	2.27 $\pm$ .09
Relative Trunk	29-37	33.70 $\pm$ .07	1.18 $\pm$ .05	3.50 $\pm$ .15
Thoracic	68-92	78.72 $\pm$ .29	4.95 $\pm$ .21	6.29 $\pm$ .26
Relative Arm Length	42-52	45.62 $\pm$ .08	1.30 $\pm$ .05	2.85 $\pm$ .12
Relative Leg Length	44-51	47.27 $\pm$ .07	1.20 $\pm$ .05	2.54 $\pm$ .11
Cephalic	67-81	73.92 $\pm$ .17	2.93 $\pm$ .12	3.96 $\pm$ .25
Length-Height	51-73	61.43 $\pm$ .21	3.59 $\pm$ .15	5.84 $\pm$ .24
Breadth-Height	69-95	83.05 $\pm$ .31	5.28 $\pm$ .22	6.36 $\pm$ .27
Cephalo-Facial	86-104	95.23 $\pm$ .20	3.42 $\pm$ .14	3.59 $\pm$ .15
Fronto-Parietal	62-78	70.81 $\pm$ .17	2.93 $\pm$ .12	4.14 $\pm$ .17
Zygomatico-Frontal	69-81	74.34 $\pm$ .15	2.52 $\pm$ .11	3.39 $\pm$ .14
Zygomatico-Gonial	67-87	77.45 $\pm$ .20	3.36 $\pm$ .14	4.34 $\pm$ .18
Facial	73-103	90.79 $\pm$ .32	5.46 $\pm$ .23	6.01 $\pm$ .25
Upper Face	41-65	53.80 $\pm$ .26	4.39 $\pm$ .18	8.16 $\pm$ .34
Nasal	61-94	74.38 $\pm$ .39	6.55 $\pm$ .27	8.81 $\pm$ .37

TABLE 9

Statistical Constants of 127 Female Ponape Islanders

Measurements

	Range	Mean	S	V
		lbs		
Weight	76-163	112.87±1.04	17.40±.74	15.42±.65
	cm	cm	cm	
Span	136-164	151.49±.35	5.80±.25	3.83±.16
Stature	140-166	151.69±.30	5.01±.21	3.30±.14
Porion	129-155	140.08±.30	5.03±.21	3.59±.15
Head Height	9-14	11.57±.05	0.82±.04	7.09±.30
Acromion	113-138	124.89±.29	4.78±.20	3.83±.16
Radiale	86-106	96.06±.23	3.78±.16	3.94±.17
Stylium	65-84	74.15±.20	3.26±.14	4.40±.19
Dactylion	50-65	57.76±.18	3.00±.13	5.19±.22
Tibiale	31-44	38.80±.14	2.32±.10	5.98±.25
Sphyrion	3-9	5.79±.04	0.70±.03	12.09±.51
Sitting Height	75-90	81.84±.16	2.70±.11	3.30±.14
Trunk Height	47-60	52.57±.14	2.39±.10	4.55±.19
Arm Length	60-73	67.17±.16	2.61±.11	3.89±.16
Leg Length	59-79	69.33±.19	3.24±.14	4.63±.20
Biacromial	29-36	32.38±.08	1.38±.06	4.11±.17
Hip Width	23-32	27.25±.09	1.53±.06	5.65±.24
	mm	mm	mm	
Head Length	169-199	183.42±.32	5.34±.23	2.91±.12
Head Width	125-153	138.17±.28	4.71±.20	3.41±.14
Minimum Frontal	90-105	98.26±.20	3.41±.14	3.47±.15
Bizygomatic	116-135	125.81±.25	4.17±.18	3.31±.14
Bigonial	81-108	97.80±.28	4.69±.20	4.80±.20
Total Face Height	100-132	114.73±.36	6.08±.26	5.30±.22
Upper Face Height	56-85	68.39±.31	5.27±.22	7.71±.33
Nose Height	40-67	53.60±.26	4.37±.19	8.15±.35
Nose Width	32-44	38.14±.14	2.36±.10	6.19±.26

Indices

Relative Span	93-106	99.83±.14	2.36±.10	2.36±.10
Relative Shoulder Width	19-24	21.36±.05	0.76±.03	3.56±.15
Relative Hip Width	16-21	17.98±.06	0.83±.04	5.17±.22
Shoulder-Hip	73-100	84.41±.29	4.79±.20	5.67±.24
Relative Sitting Height	51-59	53.97±.07	1.11±.05	2.06±.09
Relative Trunk	32-41	34.66±.07	1.24±.05	3.58±.15
Relative Arm Length	42-47	44.24±.06	0.97±.04	2.19±.09
Relative Leg Length	42-49	46.06±.06	1.08±.05	2.34±.10
Cephalic	68-84	75.35±.17	2.88±.12	3.82±.16

TABLE 9 (Cont)

	<u>Range</u>	<u>Mean</u>	<u><math>\sigma</math></u>	<u>V</u>
Length-Height	51-73	63.08 $\pm$ .29	4.78 $\pm$ .20	7.58 $\pm$ .32
Breadth-Height	68-98	83.69 $\pm$ .35	5.80 $\pm$ .25	6.93 $\pm$ .29
Cephalo-Facial	77-101	91.04 $\pm$ .19	3.15 $\pm$ .13	3.46 $\pm$ .15
Frontal-Parietal	64-78	71.09 $\pm$ .17	2.76 $\pm$ .12	3.88 $\pm$ .16
Zygomatico-Frontal	72-85	78.22 $\pm$ .15	2.49 $\pm$ .11	3.18 $\pm$ .13
Zygomatico-Gonial	63-86	77.78 $\pm$ .20	3.36 $\pm$ .14	4.32 $\pm$ .18
Facial	78-108	91.33 $\pm$ .35	5.80 $\pm$ .25	6.35 $\pm$ .27
Upper Face	44-69	54.46 $\pm$ .28	4.65 $\pm$ .20	8.50 $\pm$ .36
Nasal	53-92	71.58 $\pm$ .46	7.74 $\pm$ .33	10.81 $\pm$ .46

Qualitative Characters

<u>Skin Colour</u> (von Luschan scale)	<u>Males</u>		<u>Females</u>	
<u>Inner Arm</u>	<u>No.</u>	<u>Per Cent.</u>	<u>No.</u>	<u>Per Cent.</u>
12	-	-	12	.79
13	-	-	13	-
14	-	-	14	3.15
15	4	3.08	15	8.66
16	3	2.31	16	9.45
17	10	7.69	17	17.32
18	90	69.23	18	50.39
19	4	3.08	19	2.36
20	1	.77	20	3.15
21	2	1.54	21	.79
22	14	10.77	22	3.15
23	2	1.54	23	.79
<u>Cheek</u>				
16	-	-	16	.79
17	-	-	17	1.57
18	4	3.08	18	2.36
19	1	.77	19	7.87
20	26	20.00	20	33.86
21	51	39.23	21	39.37
22	30	23.08	22	10.24
23	9	6.92	23	3.15
24	6	4.62	24	.79
25	3	2.31	25	-
<u>Hair Form</u>				
Straight	32	24.62	44	34.65
Low waves	53	40.77	81	63.78
Deep waves	45	34.61	2	1.57
Curly	-	-	-	-
Frizzly	-	-	-	-
Woolly	-	-	-	-
<u>Hair Texture</u>				
Coarse	-	-	-	-
Medium	123	94.62	9	7.09
Fine	7	5.38	118	92.91
<u>Hair Colour</u>				
Black	5	3.85	-	-
Dark Brown	109	83.85	102	80.31
Reddish-brown	5	3.85	22	17.32
Light brown	-	-	-	-
Dark brown-gray	8	6.15	3	2.36
Gray	3	2.31	-	-
<u>Baldness</u>				
Absent	115	88.46	124	97.64
Medium	14	10.77	3	2.36
Marked	1	.77	-	-

<u>Beard</u>	<u>Males</u>		<u>Females</u>	
	<u>No.</u>	<u>Per Cent.</u>	<u>No.</u>	<u>Per Cent.</u>
<u>Upper Cheek</u>				
Absent	9	6.92	127	100.00
Slight	118	90.77	-	-
Medium	3	2.31	-	-
<u>Lower Cheek</u>				
Absent	6	4.62	127	100.00
Slight	121	93.07	-	-
Medium	3	2.31	-	-
<u>Chin</u>				
Absent	-	-	127	100.00
Slight	87	66.92	-	-
Medium	42	32.31	-	-
Heavy	1	.77	-	-
<u>Moustache</u>				
Absent	-	-	126	99.21
Slight	80	61.54	1	.79
Medium	49	37.69	-	-
Heavy	1	.77	-	-
<u>Body Hair</u>				
<u>Chest</u>				
Absent	84	64.62	127	100.00
Slight	37	28.46	-	-
Medium	9	6.92	-	-
Heavy	-	-	-	-
<u>Forearm</u>				
Absent	5	3.85	65	51.18
Slight	78	60.00	61	48.03
Medium	47	36.15	1	.79
Heavy	-	-	-	-
<u>Leg</u>				
Absent	2	1.54	42	33.07
Slight	38	29.23	82	64.57
Medium	90	69.23	3	2.36
Heavy	-	-	-	-
<u>Eye Colour</u>				
Black	-	-	1	.79
Dark brown	126	96.92	125	98.43
Light brown	4	3.08	1	.79
Blue-brown	-	-	-	-
Gray-brown	-	-	-	-
<u>Iris</u>				
Homogeneous	47	36.15	76	59.84
Speckled	-	-	-	-
Rayed	12	9.23	12	9.45
Zoned	34	26.15	25	19.69
Rayed and Zoned	37	28.46	14	11.02

-18-  
Table 10

	<u>Males</u>		<u>Females</u>	
	No.	Per Cent.	No.	Per Cent.
<u>Sclera</u>				
Clear	5	3.85	20	15.75
Speckled	1	.77	-	-
Yellow	-	-	1	.79
Dull	2	1.54	10	7.87
Bloodshot	47	36.15	57	44.88
Dull and Bloodshot	75	57.69	39	30.71
<u>Eye Fold</u>				
Absent	130	100.00	125	98.43
Epicanthus				
Median				
Trace	-	-	2	1.57
Medium	-	-	-	-
Marked	-	-	-	-
Lateral				
Trace	-	-	-	-
Medium	-	-	-	-
Marked	-	-	-	-
<u>Palpebral Opening</u>				
Narrow	3	2.31	1	.79
Medium	125	96.15	124	97.64
Wide	2	1.54	2	1.57
Up	130	100.00	127	100.00
Down	-	-	-	-
<u>Eyebrows</u>				
Thin	12	9.23	57	44.88
Medium	107	82.31	67	52.76
Thick	11	8.46	3	2.36
<u>Concurrency</u>				
Absent	23	17.69	39	30.71
Trace	107	82.31	88	69.29
Marked	-	-	-	-
<u>Brow Ridge</u>				
Median	114	87.69	125	98.43
Continuous	16	12.31	2	1.57
<u>Nasal Bridge</u>				
Low	16	12.31	32	25.20
Medium	100	76.92	93	73.23
High	14	10.77	2	1.57
<u>Nasal Profile</u>				
Straight	28	21.54	20	15.75
Convex	44	33.85	28	22.05
Concave	47	36.15	71	55.91
Concavo-convex	11	8.46	8	6.30

-19-  
Table 10

<u>Forehead</u>	<u>Males</u>		<u>Females</u>	
	<u>No.</u>	<u>Per Cent.</u>	<u>No.</u>	<u>Per Cent.</u>
<u>Marked slope</u>				
Low	1	.77	-	-
Medium	6	4.62	-	-
High	-	-	-	-
<u>Medium slope</u>				
Low	-	-	1	.79
Medium	109	83.85	104	81.89
High	11	8.46	4	3.15
<u>Vertical</u>				
Low	-	-	-	-
Medium	2	1.54	16	12.60
High	1	.77	2	1.57
<u>Glabella</u>				
Smooth	6	4.62	45	35.43
Medium	107	82.30	81	63.78
Prominent	17	13.08	1	.79
<u>Lips</u>				
Thin	1	.77	-	-
Medium	85	65.38	101	79.53
Thick	44	33.85	26	20.47
<u>Lip seam</u>				
Slight	28	21.54	38	29.92
Medium	82	63.08	71	55.91
Marked	20	15.38	18	14.17
<u>Chin</u>				
Prominent	4	3.08	5	3.94
Medium	113	86.92	110	86.61
Receding	13	10.00	12	9.45
<u>Prognathism</u>				
Absent	75	57.69	78	61.42
Alveolar				
Slight	16	12.31	15	11.81
Medium	6	4.62	5	3.94
Marked	-	-	-	-
Facial				
Slight	26	20.00	20	15.75
Medium	7	5.38	7	5.51
Marked	-	-	2	1.57
<u>Lambdoid Flattening</u>				
Trace	108	83.08	124	97.64
Medium	22	16.92	3	2.36
Marked	-	-	-	-

Table 10

	<u>Males</u>			<u>Females</u>	
<u>Ear Lobe</u>	<u>No</u>	<u>Per Cent</u>		<u>No</u>	<u>Per Cent</u>
Absent	1	.77		3	2.36
Separate					
Small	55	42.31		57	44.88
Large	37	28.46		27	21.26
Attached					
Small	34	26.15		23	18.11
Large	3	2.31		17	13.39
<u>Helix Rolled</u>					
1/3	82	63.07		91	71.65
2/3	43	33.08		32	25.20
3/3	5	3.85		4	3.15
Flat	-	-		-	-
<u>Darwin's point</u>					
Absent	130	100.00		127	100.00
Present	-	-		-	-

METHOD

The measurements used follow the standards set by the International Agreement, with the exception of weight, which was obtained by using a portable bathroom scale. The measurements are as follows:-

1. Weight	10. Sphygmon	19. Head Width
2. Span "	11. Sitting Height	20. Minimum Frontal
3. Stature	12. Trunk Height	21. Bzygomatic
4. Psonion	13. Biaxromial	22. Bigonial
5. Acromion	*14. Chest Width	23. Total Face Height
6. Radiale	*15. Chest Depth	24. Upper Face Height
7. Stylion	*16. Chest Girth	25. Nose Height
8. Dactylion	17. Hip Width	26. Nose Width
9. Tibiale	18. Head Length	

\*These measurements were not done on females.

By subtraction according to the projective technique the following were obtained:-

1. Head Height
2. Arm Length
3. Leg Length

Observations were made on skin colour; hair form, texture, and colour; amount of facial and body hair; eye colour, iris, sclera; epicanthus; eyebrows; brow ridge; nasal bridge and profile; slope of forehead; lip thickness; chin; prognathism; lambdoid flattening; ear lobe, roll of helix, Darwin's point; and teeth.

DESCRIPTION OF PONAPE ISLANDERS

The statistical constants of the males and females are shown in tables 8 and 9, and the percentage calculations of the qualitative characters in table 10.

From these tables it can be seen that Ponape Islanders are characterized by a moderate stature. They have long and narrow heads, with a dolicocephalic index. The facial index indicates leptoprosopy or narrow faces, due to the relatively greater face length. The nasal index is closer to the lower limits of mesorhiny, especially among

the females, and is due to the size of the absolute nose length. However, it should be stressed that both face and nose height are based on nasion - a hard-to-find and much-debated landmark, which produces great variability in facial and nasal indices. In relation to the width of the face the forehead is not particularly narrow, even less so in the females, which accounts for their greater zygomatico-gonial index. Both the relative sitting height and trunk height indices indicate a relatively long trunk, expressed as a percentage of the height.

Most of the males have an unexposed skin colour around 17 and 18 on the von Luschan scale. The females fall mostly between 15 and 18. On the exposed surface the males are darker, in general between 20 and 22, the females are about the same, between 19 and 22. Curly, frizzly, or woolly hair is not present. The males show far more deep waves than the females. Hair colour is dark brown, females having more reddish-brown hair than males. Facial and body hair is only moderately developed. Eye colour is dark brown. The iris is more homogeneous in the females.

It is interesting to note how few of either sex have clear scleras, most males and females have either bloodshot or dull and bloodshot scleras. The epicanthic eye fold is almost entirely absent. Most males and females have a medium nasal bridge and concave nasal profile, although a considerable number of both sexes have also convex and straight noses. Most males and females have a forehead with a medium slope and medium height, and a medium sized glabella. Lips are mainly medium in thickness with a medium lip seam. Prognathism when present, is more facial than alveolar, with most chins medium size.

TABLE 11.

## Comparison of Ponape Islanders with other Caroline Islanders (including Marshall)

Group	No	Stature	Acromion Height	Arm Length	Head Length	Width	Males		Females		
							cm	cm	mm	mm	
1. S. W. Carolines	11	164.4			194.5	138.5			137.4	101.5	
Togobei (Hasebe)	6	156.8			191.2	139.2			136.2	104.3	
3. Mortlocks (Hirako)	12	164.4(2)			193.2	139.3			136.7	116.7	
4. Truk (Hirako)	29	164.0(48)			194.3	139.6			136.4	101.5	
5. Truk (Hambruch)	14	160.2			69.3	189.5	136.4		120.3	87.0	
<b>6. West Carolines</b>											
7. Mogmog (Hirako)	8	165.2			194.5	143.2			111.1	102.7	
8. Oleai (Hirako)	7	162.0(6)			195.5	146.4			108.4	100.7	
9. Ponape (Murrill)	130	163.2	134.3	74.3	191.9	141.8	100.5	135.1	104.6	97.1	
10. Kusai (Hirako)	8	162.3(9)			193.6	147.7			106.5	102.3	
11. Jaluit (Hirako)	11	165.5(31)			189.0	145.4			107.0	101.3	
12. Marshall's (Finseb)	12	163.6	132.9	72.0	190.6				129.0	123.1	
13. Yap (Hasebe)	46	160.5			189.1	146.5			113.9	101.5	
14. Yap (Hambruch)	7	163.5			70.1	187.6	146.0		111.1	107.0	
15. Yap (Hirako)	8	163.7				190.6	149.9			112.4	107.0
16. Palau (Hambruch)	9	161.7			71.2	185.4	147.2		111.2	101.9	
17. Palau (Hasebe)	140	160.9			185.4	149.6			111.6	106.7	
18. Palau (Hirako)	8	162.8			185.4	149.6			111.7	101.0	

## Marshall Islanders a)

Case No.	Width mm	Cephalic Index	Length-Height Index	Cephalo-Facial Index	Facial Index	Nasal Index
	71.3	62.9		94.6	73.1	
	73.1	64.4		85.6	84.7	
	72.0			86.1(10)		
	71.8			89.0(28)		
39.4	71.9			97.1		85.6
	73.6	64.6			89.7	76.3
	74.4				89.7	
	75.2				85.0	
42.3	73.9	61.4		95.2	90.7	74.3
	76.3				88.6(7)	
	76.9					
43.0						
	77.7	64.3			85.5	75.4
40.9	77.8			96.7	81.9	85.4
	78.6					
41.0	79.4			96.7		88.1
	80.9				87.2	76.3(139)
	82.1					81.6

Ear lobes are mainly separate, with the helix of the ear 1/3 rolled, and Darwin's point is completely absent. Dental conditions are treated in detail in a subsequent section.

COMPARISON OF PONAPE ISLANDERS WITH OTHER GROUPS  
IN MICRONESIA

While seeking to find a possible relation between the Ontong Javanese and Micronesians, Shapiro ('33) compared the various Micronesian groups with each other. I have used his summary of males extensively, but I have altered slightly the order of the various groups, including my Ponape series rather than Hirako's ('26) series of 8 males.

The male Micronesian groups are summarized in table 11, the females in table 12. The various Micronesians have been arranged, for the sake of convenience, in three main groups according to similarity of the cephalic index.

The first group consists of the Southwestern Carolines - Sonsol, Menir, and Bur (or Pul), Togobei (or Tobi), Montlocks, and Truk. In this group stature ranges from 160.2 cm to 164.4 cm (excepting Togobei). Head length ranges between 189.5 and 194.5 mm; head width from 136.4 to 139.6 mm; face width from 132.3 to 137.4 mm; and cephalic index from 71.3 to 73.1.

The second group includes the West Carolines - Satoval, Lamotrek, Elato, Ifalik, Auepig (or Eau-ipik), Voleai (or Oleai), Fais, and Mogmog (or Ulithi), Mogmog, Oleai, Ponape, Kusaie, Jaluit, and the Marshalls. In this group stature is similar to the first group and ranges from 162.0 to 165.5 cm; head length is also similar from 189.0 to 194.5 mm; head widths are broader from 141.8 to 147.7 mm; and the cephalic index ranges from 73.6 to 76.9.

TABLE 13. Differences from Ponape Island Means. Males

	S. W. Carolines	Togobei	Mort-locks	Truk	West Caro-lines	Mogmog	Oleai	Kusale	Jaluit	Mar-shalls	Yap	Yap	Palau	Palau	Palau	Palau	Palau	Palau
No.	11	6	12	29	34	45	8	7	8	10	11	12	13	14	15	16	17	18
Stature	1.2	-6.4	1.2	0.8	-3.0	0.6	2.0	-1.2	-0.9	2.3	0.4	-2.7	0.3	0.5	-1.5	-2.3	-0.4	
Hacromion																		
Height																		
Arm Length																		
Head Length	2.6	-0.7	1.3	2.4	-2.4	2.6	3.6	1.2	1.7	-2.9	-1.3	-2.8	-4.3	-1.3	-6.5	-6.5	-7.5	
Head Width	-3.3	-2.6	-2.5	-2.2	-5.4	1.4	4.6	3.5	5.9	3.6	4.7	4.2	8.1	5.4	7.8	9.8		
Minimum Frontal Face																		
Width	2.3	1.1																
Bigonial	-3.1	-0.3																
Face Height	8.2	-5.9																
Nose Height																		
Nose Width	3.5	2.8	2.5	4.0	4.6	2.5	4.5	4.0	3.6	2.9	2.6	3.8	4.2	4.1	5.1	4.3	7.2	
Indices																		
Cephalic	-2.6	-0.8	-1.9	-2.1	-2.0	-0.3	0.5	1.3	2.4	3.0	3.8	3.9	4.7	5.5	7.0	8.2		
Length-Height	1.5	3.0																
Cephalo-Facial																		
Nasal	-1.2	10.4	-5.1	-4.6	-1.7	1.9	-1.0	-5.7	-2.1									
Average Difference	2.3	4.8	3.3	1.9	5.1	1.6	0.8	3.5	2.3	(3.0)	-	3.3	5.5	6.8	6.9	4.6	8.7	
Total																		
Average Difference	3.0	3.6	2.8	3.3	4.8	2.2	3.3	3.9	3.2	(3.0)	(2.6)	3.6	4.6	5.6	4.4	7.7		

The third group is composed of Yap and the Palaus. Again stature is similar, ranging from 160.5 to 163.7 cm; however, this group has the shortest heads, from 184.4 to 190.6 mm; the widest heads, from 146.0 to 151.6 mm; and faces, from 141.1 to 143.9 mm; the narrowest jaws, from 101.3 to 101.9 mm; and the cephalic index ranges from 77.7 to 82.1.

In regard to metric approximations which groups stand closest to Ponape? For the males, from table 11, it can be seen that Ponape in stature approximates all three groups. Again with the exception of Togobei, the total average difference of the means in stature from the Ponape means is only 1.3 cm. In head length the closest is Togobei; in head width the West Carolines; in minimum frontal the Mortlocks; in face width Togobei; in bigonial Togobei; in face height Palau; in nose height and width the Marshalls; in cephalic and facial indices the West Carolines.

However, if one takes the configuration of physical traits and finds the total average difference of the means of the various Micronesian groups from the Ponape means, a somewhat clearer picture emerges. This is shown in table 13 for the males. Using this rough method of finding group similarity or divergence, the closest group to Ponape is now the West Carolines followed by the Mortlocks and the Southwestern Carolines. The most divergent groups are Yap and Palau. There also appears to be some relation between Ponape and the Marshalls (No. 12). It is interesting to note that some Ponape natives informed me that the Ponape clan called Naniak was originally composed of Marshall Islanders.

TABLE 12  
Comparison of Ponape Islanders with other Caroline Islanders

Group	No	Stature	Arm Length	Head		Face		Nose		Cephalic Length-Height Index		Breadth-Height Index		Cephalo-Facial Index		Nasal Index	
				cm	cm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		
1.	S/W/Carolines (Hasebe)	9	154.8		182.3	137.0	129.2					74.7	66.0			70.9	
2.	Truk (Hirako)	5	153.0		183.6	137.3						74.8				85.7 (3)	
3.	Truk (Hambruch)	3	153.4		66.2	183.3	134.7					73.8	63.8	86.8	90.4	82.7	
4.	Ponape (Murrill)	127	151.6	67.1	183.4	138.1	125.8	114.7	53.6	38.1	75.3	63.0	83.6	91.0	91.3	71.5	
5.	Jaluit (Hirako)	8	148.0		180.1	143.5						79.9				90.9	
6.	Yap (Hambruch)	6	148.0		62.7	178.8	137.8					43.7	39.0	77.1	62.5	81.0	95.6(5)
7.	Palau (Hasebe)	76	152.5		175.0	144.2	135.1	116.8						82.5	68.5	88.8	72.1

TABLE 14. Females. Differences from Ponape Island Means.

	Southwestern Carolines (1)	Truk (2)	Truk (3)	Jaluit (5)	Yap (6)	Palau (7)
No.	9	5	3	8	6	76
Stature	3.2	1.4	1.8	-3.6	-3.6	0.9
Arm Length			-0.9		-4.4	
Head Length	-1.1	0.2	-0.1	-3.3	-4.6	-8.4
Head Width	-1.1	-0.8	-3.4	5.4	-0.3	6.1
Face Width	3.4					9.3
Face Height						2.1
Nose Height					-9.9	
Nose Width					0.9	
Average Difference	2.2	0.8	1.6	4.1	4.0	5.4
<u>Indices</u>						
Cephalic	-0.6	-0.5	-1.5	4.6	1.8	7.2
Length-Height	3.0		0.8		-0.5	5.5
Breadth-Height			3.2		-2.6	
Cephalo-Facial			-0.6		4.6	
Facial		-5.6		-0.4		-2.5
Nasal	-0.6		11.2		19.2	0.6
Average Difference	1.4	3.1	3.5	2.5	5.7	4.0
Total Average Difference	1.9	1.7	2.6	3.5	4.8	4.7

TABLE 15. Hair Form of Ponape and other Caroline Islanders.

	Total	No	Males		Curly		Frizzly	
			Straight and Low Waves	Medium and Deep Waves	No	%	No	%
Ponape	130	85	65.39	45	34.61	0	0	0
West Carolines	43	0	0	7	16.28	32	74.42	4
Southwestern Carolines	10	0	0	5	50.00	5	50.00	0
Yap	46	1	2.17	17	36.96	23	50.00	5
Palau	118	5	4.24	35	29.66	67	56.78	11
<u>Females</u>								
Ponape	127	125	98.43	2	1.57	0	0	0
Southwestern Carolines	9	3	33.33	3	33.33	3	33.33	0
Palau	76	7	9.21	43	56.58	21	27.63	5

TABLE 16. Skin Colour of Ponape and other Caroline Islanders.

Inner side of upper arm von Luschan scale	10-12	Males						
		Total	No	No	%	No	%	No
Ponape	130	0	0	4	3.08	103	79.23	7
West Carolines	41	0	0	5	12.19	18	43.90	0
Southwestern Carolines	11	0	0	1	9.09	5	45.45	0
Yap	42	0	0	3	7.14	25	59.52	0
Palau	138	0	0	3	2.17	16	11.59	0
<u>Females</u>								
Ponape	127	1	0.79	15	11.81	98	77.16	8
Southwestern Carolines	9	1	11.11	7	77.78	1	11.11	0
Palau	75	4	5.33	11	14.67	32	42.67	0

Comparison of Ponape Islanders with Gilbert Islanders, natives of Kapingamarangi, Society Islanders, Samoans, Marquesans, and Maoris.

	<u>Males</u>						
	Ponape	Gilbert	Kapinga- maangi	Society	Samoan	Mar- quesas	Maori
Statue (cm)	163.2	169.5	171.1	171.3	171.7	170.3	170.6
Acromion (cm)	134.3	142.6		143.3		141.6	
Arm Length (cm)	74.3	77.9		79.9		79.6	
Head Length (mm)	191.9	190.7	195.4	188.0	190.6	193.2	196.5
Head Width (mm)	141.8		153.3	159.5	154.8	153.2	152.8
Face Width (mm)	135.1		144.6	145.7	145.9	143.2	145.7
Face Height (mm)	122.6	135.9	117.3	124.7	131.1	124.1	124.0
Nose Height (mm)	57.1	57.8	52.6	54.2	59.8	53.1	52.8
Nose Width (mm)	42.3	43.9	45.0	43.4	43.8	43.2	40.1
<u>Indices</u>							
Cephalic	73.9		78.5	84.9	81.3	79.4	77.7
Cephalo- Facial	95.2		94.4	91.3	94.2	93.5	95.3
Facial	90.7		81.1	85.7	89.9	87.0	85.1
Nasal	74.3		85.7	80.3	73.6	81.9	75.9

The female series shown in table 12, excluding Ponape and Palau, are indeed small in size. For all the groups taken together stature ranges from 148.0 to 154.8 cm, with Ponape about midway in the range. Closest to Ponape in arm length is Truk (No. 3); in head length Truk (No. 3); in head width Yap; in face width the Southwestern Carolines; in cephalic index Truk (No. 2) and the Southwestern Carolines; in facial index Jaluit; in nasal index the Southwestern Carolines (and Palau).

The total average difference of the means of the various groups from the Ponape means is shown in table 14 for the females. If we again consider the configuration of physical traits the closest group appears to be Truk (No. 2) or the Southwestern Carolines, the latter series being somewhat larger. Yap and Palau are the most divergent.

Comparative hair form and skin colour are shown in tables 15 and 16. For both males and females Ponape Islanders have straighter hair and lighter skins than other Caroline Islanders. However, the Ponape females are closer in both hair form and skin colour to the Southwestern Carolines than to Palau.

Since Kapingamarangi (or Greenwich Island) was included in the Ponape Branch Bureau under the Japanese, a series gathered by Schlaginhaufen ('29) is compared with Ponape in table 17. Also shown in this table is an unpublished series of Gilbert Islanders obtained by Finsch and quoted by Shapiro ('33), and various Polynesian groups. It can be seen at once that the means of the natives of Kapingamarangi, with the exception of face height, are much closer to the Polynesian than to the Ponape means. Compared with Ponapeans the natives of Kapingamarangi are taller, have wider heads and faces, and shorter but wider noses. Although head width is missing in the Gilbert Islanders series, they would appear to resemble Polynesians more than other Micronesians.

TABLE 18. Comparison of Ponape Islanders and Ontong Javanese.

	<u>Males</u>		<u>Females</u>	
	Ponape	Ontong Javanese	Ponape	Ontong Javanese
Stature (cm)	163.2	163.6	151.6	153.2
Acromion (cm)	134.3	134.6	124.8	125.7
Arm Length (cm)	74.3	71.2	67.1	65.3
Biacromial (cm)	36.6	36.5	32.3	33.1
Head Length (mm)	191.9	193.0	183.4	181.4
Head Width (mm)	141.8	143.0	138.1	136.3
Face Width (mm)	135.1	134.6	125.8	123.0
Bigonial (mm)	104.6	103.3	97.8	97.6
Face Height (mm)	122.6	117.3	114.7	106.5
Nose Height (mm)	57.1	48.4	53.6	44.2
Nose Width (mm)	42.3	40.3	38.1	37.2
<u>Indices</u>				
phalic	73.9	74.1	75.3	75.2
Cephalo-Facial	95.2	94.0	91.0	90.2
Zygomatico-Gonial	77.4	76.7	77.7	79.5

TABLE 19. Comparison of Standard Deviations.

	<u>Males</u>		<u>Females</u>	
	Ponape	Ontong Janvanese	Ponape	Ontong Janvanese
Stature	6.00	5.96	5.01	5.05
Acromion	5.51	5.34	4.78	5.09
Arm Length	3.60	3.33	2.61	3.32
Biacromial	1.60	2.08	1.33	1.64
Head Length	6.12	6.30	5.34	6.25
Head Width	4.14	4.89	4.71	3.81
Face Width	4.44	6.20	4.17	5.53
Bigonial	4.82	5.75	4.69	5.16
Face Height	6.82	7.08	6.08	5.81
Nose Height	3.97	3.50	4.37	3.44
Nose Width	2.50	2.72	2.36	2.67
<u>Indices</u>				
Brachial	2.93	2.82	2.88	2.69
Cephalo-Facial	3.42	4.50	3.15	4.58
Zygomatico-Gonial	3.36	4.39	3.36	4.53
Facial	5.46	5.70	5.80	5.66
Nasal	6.55	6.70	7.74	8.76
Average (Total)	4.45	4.83	4.27	4.62

TABLE 20

Hair Form of Ponape Islanders and Ontong Javanese

Males

	Total No.	No.	%	No.	%	No.	%
Ponape	130	85	65.39	45	34.61	0	0
Ontong Javanese	98	56	57.15	32	32.65	10	10.20

Females

Ponape	127	125	98.43	2	1.57	0	0
Ontong Javanese	53	49	92.45	4	7.55	0	0

Skin Colour of Ponape Islanders and Ontong Javanese

Males

Inner side of Upper Arm von Luschan scale	10-12	13-15	16-18	19-21	22-24						
	Total No	No	%	No	%	No	%	No	%	No	%
Ponape	130	0	0	4	3.08	103	79.23	7	5.39	16	12.31
Ontong Javanese	87	1	1.15	44	50.57	33	37.94	3	3.45	6	6.90

Females

Ponape	127	1	0.79	15	11.81	98	77.16	8	6.30	5	3.94
Ontong Javanese	52	6	11.54	42	80.77	4	7.70	0	0	0	0

In comparing the Ontong Javanese with various Micronesian groups Shapiro ('33) came to the conclusion, in view of the existing evidence, that they resembled more closely the natives of the West Carolines than other Caroline groups.

The means of the Ontong Javanese and Ponape Islanders are compared together in table 18. Except for face and nose height, both based on the landmark nasion, the similarity between the natives of both islands is certainly striking enough to warrant them being related. In table 19 the standard deviations of the two groups have been averaged, disregarding the units of measurement. Both groups exhibit a similar average variability, the Ponape Islanders being slightly less variable than the Ontong Javanese. From table 20 one can see that the two groups are similar in hair form. However, Ponape Islanders appear to be darker in skin colour.

In regard to the former inhabitants of Micronesia there is, as far as I know, no stratified archaeological evidence. However, Hasebe ('26) gives a mean cephalic index of 74 for 96 skulls from the Carolines, slightly larger in males than in females, with Yap and Palau at one end and Kusaie at the other being more inclined to mesocephaly. This would seem to indicate a former rather dolicocephalic population spread throughout Micronesia, being modified later in physical characters by the more brachycephalic and Malay-like Yap and Palau types, who are concentrated in the West Carolines and are probably more recent arrivals. Possibly Ponape and Kusaie have been modified from the East by way of the Marshalls.

TABLE 21

MALES. Teeth lost, teeth carious, % of teeth with caries.

Age	No	No of teeth lost*	Teeth lost average per person	No of non-erupted teeth	Non-erupted teeth average per person	No of carious teeth	Carious teeth average per person	% of teeth with caries	% of teeth with caries
20-24	11	u. 24 l. 11	2.2 1.0	16	1.5	u. 50 l. 34	4.5 3.1	25.0	16.3
25-34	48	u. 69 l. 107	1.4 2.2	58	1.2	u.145 l.177	3.0 3.7	21.8	11.2
35-44	29	u.107 l.129	3.7 4.4	33	1.1	u.141 l.152	4.9 5.2	32.7	8.6
45-54	28	u.174 l.161	6.2 5.8	25	0.9	u.199 l.172	7.1 6.1	42.6	6.7
55-64	14	u.120 l.131	8.6 9.4	4	0.3	u.127 l.132	9.1 9.4	58.3	4.1
All ages	130	u.494 l.539	3.8 4.1	136	1.0	u.662 l.667	5.1 5.1	33.0	9.9

u. equals upper jaw l. equals lower jaw.

\* Teeth lost excludes non-erupted third molars.

† No. of carious teeth includes teeth lost and carious teeth, but excludes non-erupted third molars.

% of teeth with caries (A) is based on teeth lost plus carious teeth.

% of teeth with caries (B) is based only on teeth remaining that are carious.

TABLE 22.

FEMALES. Teeth lost, teeth carious, % of teeth with caries.

Age	No	No of teeth lost* per person	Teeth lost average	No of non-erupted third molars	Non-erupted third molars average	No of carious teeth	Carious teeth average	% of teeth with caries per person	% of teeth with caries A	% of teeth with caries B
20-24	11	u. 5	0.5			u. 19	1.7			
		l. 5	0.5	13	1.2	l. 23	2.1	12.4	9.7	
25-34	45	u.129	2.9			u.197	4.4			
		1.139	3.1	75	1.7	1.194	4.3	28.6	11.2	
35-44	33	u.196	5.9			u.252	7.6			
		1.180	5.5	31	6.9	1.207	6.3	44.8	12.8	
45-54	28	u.230	8.2			u.247	8.8			
		1.225	8.0	27	0.9	1.234	8.4	55.4	6.3	
55-64	5	u. 38	7.6			u. 41	8.2			
		l. 46	9.2	1	0.2	l. 46	9.2	54.7	4.0	
ages	11	u.598	4.9			u.756	6.2			
	122	1.595	4.9	147	1.2	1.704	5.8	38.9	10.4	

u. equals upper jaw. l. equals lower jaw.

\* Teeth lost excludes non-erupted third molars.

† No. of carious teeth includes teeth lost and carious teeth, but excludes non-erupted third molars.

% of teeth with caries (A) is based on teeth lost plus carious teeth.

% of teeth with caries (B) is based only on teeth remaining that are carious.

DENTAL CONDITIONS.

130 males and 122 females, both groups between the ages of 20 and 64, had their teeth examined by means of a dental mirror and probe. The following were recorded. The number of teeth lost, the number of teeth with caries and the number of filled teeth (any filled tooth or tooth with a single cavity was considered as carious). The presence and degree of shovel-shaped upper incisors, the position of upper mesial incisors, and the projection of upper incisors. The number of cusps on the lower second molars. The nature of the bite or dental occlusion, and the non-eruption of third molars.

Probably the majority of natives never had any sound dental work done, barring the occasional gold caps put on by the former Japanese dentist, at any rate the number of filled teeth seen was extremely small. It is doubtless safe, therefore, to assume that missing teeth were also carious.

The general condition of the teeth is summarized for the males and females in tables 21 and 22. For the total group of males the average number of lost teeth per person is 7.9, the average number of carious teeth per person is 10.2, and the percent of teeth with caries (A) is 33.0. For the total group of females the average number of lost teeth per person is 9.8, the average number of carious teeth per person is 12.0, and the per cent of teeth with caries (A) is 38.9. In the males the 20-24 year age group has a greater percentage of carious teeth (A) than the 25-34 year age group, with a subsequent percentage increase throughout the age groups. In the females, however, there is a steady increase in the percentage of carious teeth (A) throughout the age groups, except for a slight decline in the 55-64 year age group.

TABLE 23.

MALES

		UPPER JAW							
Age	No	I	I	C	PM	PM	M	M	M
20-24	11	10 45.5	6 27.3	2 9.1	2 9.1	5 22.7	11 50.0	10 45.5	4(5) 23.5
25-34	46	6 6.5	5 5.4	2 2.2	13 14.1	16 17.4	33 35.9	46 50.0	24(28) 37.5
35-44	28	13 23.2	14 25.0	10 17.9	12 21.4	16 28.6	28 50.0	27 48.2	21(16) 52.5
45-54	28	19 33.9	12 21.4	15 26.8	22 39.3	27 48.2	31 55.4	36 64.3	37(10) 80.4
55-64	14	14 50.0	12 42.9	10 35.7	15 53.6	13 46.4	19 67.9	22 78.6	22(2) 84.6
LOWER JAW									
20-24	11	0 ---	1 4.5	0 ---	0 ---	1 4.5	12 54.5	17 77.3	3(11) 27.3
25-34	46	5 5.4	2 2.2	1 1.1	7 7.6	19 20.7	46 50.0	61 66.3	36(30) 58.1
35-44	28	6 10.7	5 8.9	7 12.5	11 19.6	16 28.6	40 71.4	39 69.6	28(17) 71.8
45-54	28	12 21.4	14 25.0	10 17.9	15 26.8	21 37.5	36 64.3	36 64.3	28(15) 68.3
55-64	14	15 53.6	10 35.7	8 28.6	10 35.7	18 64.3	23 82.1	24 85.7	24(2) 92.3

In each age group the first row of figures represents the total number of carious teeth. The figures in brackets represent the total number of non-erupted third molars. The second row of figures represents the derived percentages.

TABLE 24

FEMALES  
UPPER JAW

Age	No	I	I	C	PM	PM	M	M	M
20-24	10	4 20.0	2 10.0	0 ---	1 5.0	1 5.0	5 25.0	5 25.0	1(7) 7.7
25-34	42	18 21.4	15 17.9	11 13.1	19 22.6	26 31.0	34 40.5	50 59.5	24(35) 49.0
35-44	33	24 36.4	26 39.4	18 27.3	23 34.8	30 45.5	45 68.2	48 72.7	38(14) 73.1
45-54	27	23 42.6	28 51.9	18 33.3	27 50.0	35 64.8	35 64.8	42 77.8	39(14) 97.5
55-64	5	3 30.0	4 40.0	4 40.0	5 50.0	5 50.0	6 60.0	6 60.0	8(9) 88.9

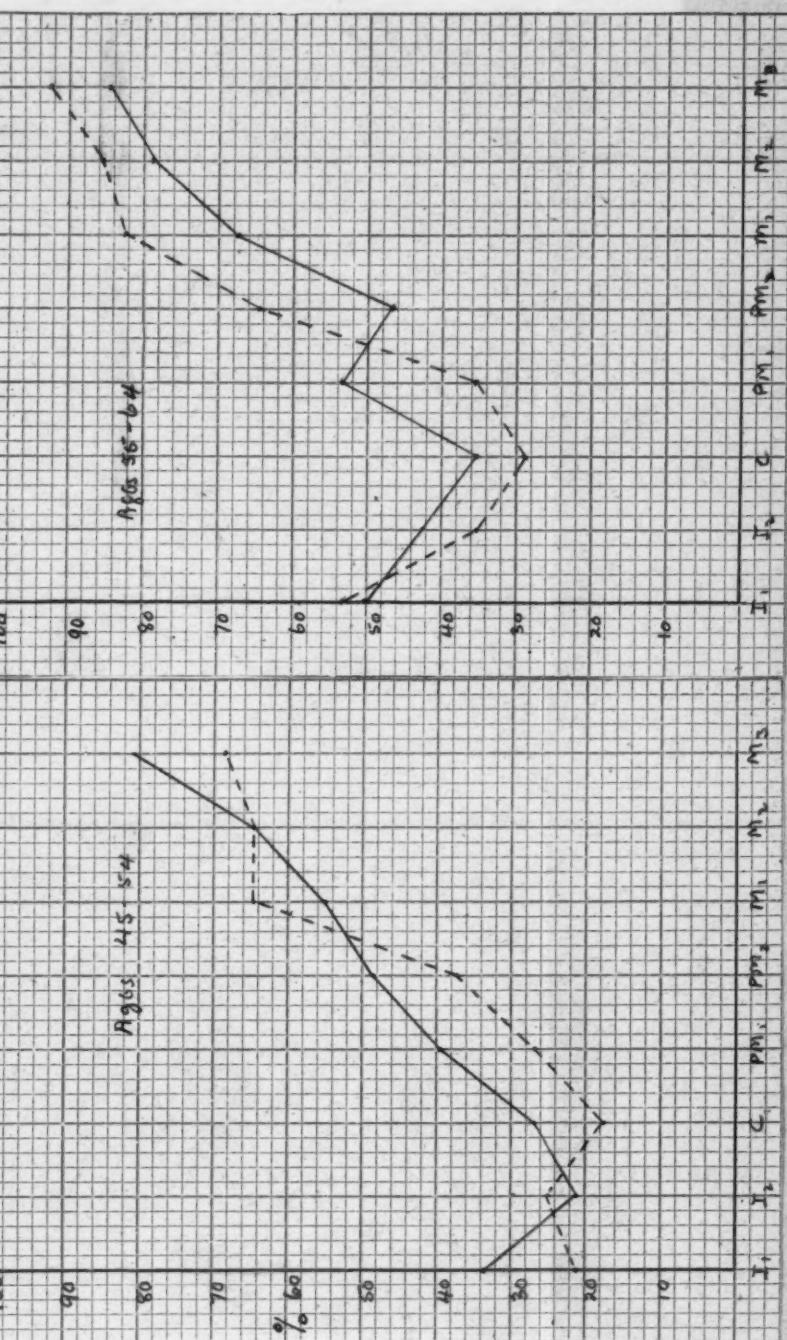
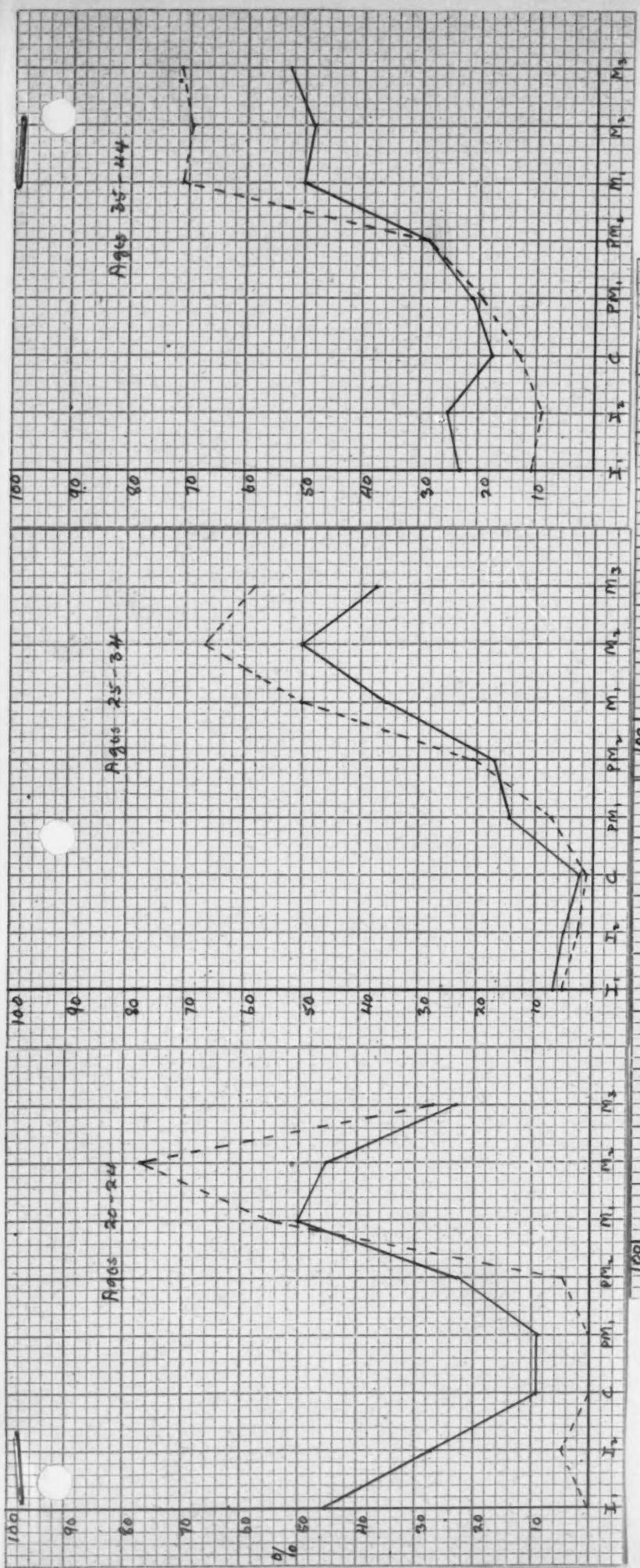
LOWER JAW

20-24	10	0 ---	0 ---	0 ---	0 ---	1 5.0	5 25.0	10 50.0	7(6) 50.0
25-34	42	0 ---	0 ---	6 7.1	9 10.7	19 22.6	59 70.2	64 76.2	37(44) 84.1
35-44	33	5 7.6	8 12.1	11 16.7	21 31.8	29 43.9	41 62.1	52 78.8	40(17) 81.6
45-54	27	17 31.5	19 35.2	21 38.9	26 48.1	26 48.1	42 77.8	44 81.5	39(13) 95.1
55-64	5	0 ---	1 10.0	4 40.0	5 50.0	7 70.0	10 100.0	10 100.0	9(0) 90.0

In each age group the first row of figures represents the total number of carious teeth. The figures in brackets represent the total number of non-erupted third molars. The second row of figures represents the derived percentages.

117 out of 130 males, or 90.0 per cent, had lost teeth. 127 out of 130 males had carious teeth and/or lost teeth, or 97.7 per cent. For the total group of males the per cent of teeth with caries (B), based only on teeth remaining that are carious is 9.9. 112 out of 122 females, or 91.8 per cent, had lost teeth. 117 out of 122 females had carious teeth and/or lost teeth, or 95.9 per cent. For the total group of females the per cent of teeth with caries (B), based only on teeth that are remaining that are carious is 10.4. These figures are added only because caries is usually cited in this fashion. In my opinion these figures do not express the general condition of caries, among these natives, as accurately as the 33.0 per cent of teeth with caries for the males, and the 38.9 per cent of teeth with caries for the females quoted above.

An attempt has been made to discover, in this group of natives, a pattern of caries development. For this reason tables 23 and 24 were constructed. Here the percentage of caries for each tooth group, based on teeth lost plus teeth carious, in the upper and lower jaw, for both males and females is recorded separately. The second row of figures in each age group shows the percentages. For example, there were 11 males in the 20-24 year age group with carious teeth (teeth lost plus teeth carious). 11 males have a total of 22 upper mesial incisors. These 11 males had 10 carious upper mesial incisors. Therefore the percentage of caries in the upper mesial incisors of these 11 males is  $10/22 \times 100$ , which equals 45.5 per cent, and so on. The same procedure was used for the lateral incisors, canines, premolars, and all molars except the third. In the latter case non-erupted third molars were first subtracted from the total number of third molars, in the upper or lower jaw, in each age group, before deriving a percentage.



MALES

— Upper Jaw

- - - Lower Jaw

FIG. 2.

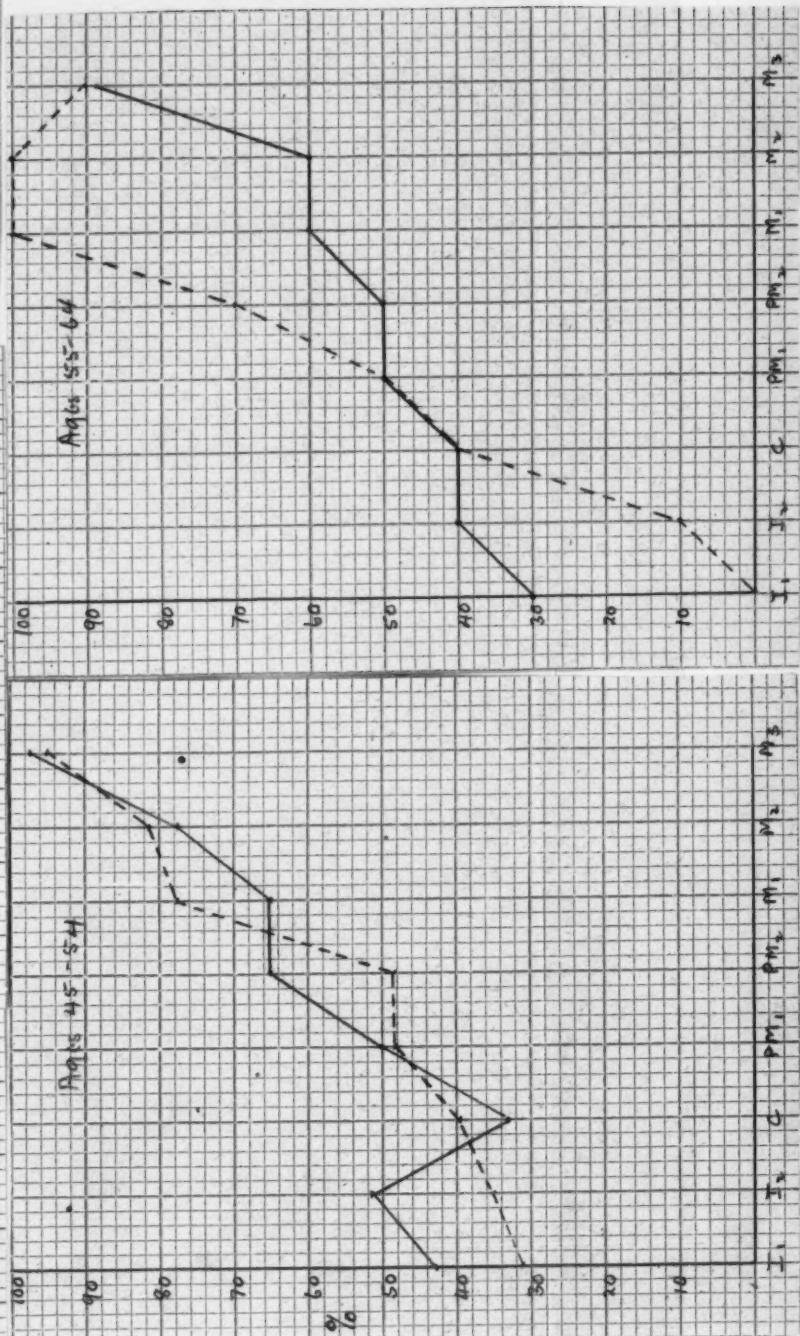
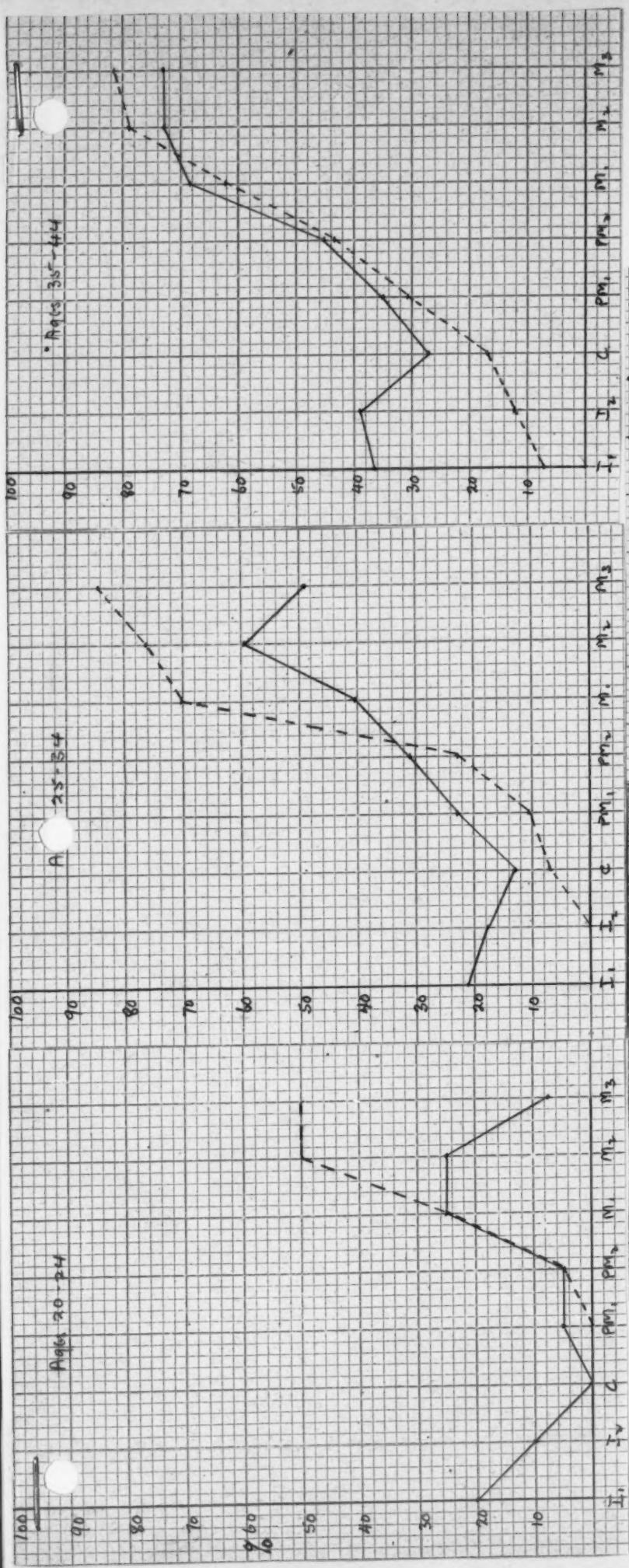


FIG. 3.

The results are shown in the accompanying graphs (Figs. 2 & 3). It is interesting to note that there is a difference in the pattern of caries between the upper and lower jaw. For both males and females, in almost every age group, the lower incisors and canines are less carious than the upper incisors and canines. The premolars are more variable with a tendency perhaps to be less carious in the lower jaw. There is also a marked tendency for the lower molars to be more carious than the upper molars. I have no explanation for the relatively high percentage of caries (and/or loss of teeth) in the upper incisors of the males and females ages 20-24 years, as I am not aware of any custom or dietary practice on Ponape which would produce such a condition.

It is not my intention to go into a general discussion of the causes of caries. There is a vast amount of dental literature on the subject, most of which is contradictory. We know that caries is much greater in modern man than it was in ancient man. It is also greater among primitive peoples who have come into contact with the white man and his foods, especially perhaps such products as sugar, than among primitive peoples who have not had such a contact (Price, '34, '35, '36). Ponape is evidently no exception to this state of affairs, having been in contact with whites (and later the Japanese) in an ever increasing degree since about 1830. The only explanation I have found to date that gets to the root of the whole question, namely function, is that of Klatsky ('48) who states; "Studies show that, from a purely nutritional viewpoint, the dietaries of most primitive people are poor, monotonous and inadequate. It is erroneous to ascribe the well developed jaw bones and muscles and the healthy teeth of the primitives to good nutrition. They enjoy these benefits in spite of inadequate nutrition. The texture of food consumed

TABLE 25

	<u>Males</u>		<u>Females</u>	
	<u>No.</u>	<u>Per Cent.</u>	<u>No.</u>	<u>Per Cent.</u>
<u>Incisor fold</u>				
Mesials				
Absent	2	1.92	4	4.04
Slight	98	94.23	94	94.95
Marked	4	3.85	1	1.01
Laterals				
Absent	3	2.65	4	4.12
Slight	106	93.81	92	94.85
Marked	4	3.54	1	1.03
<u>Position of upper mesial incisors</u>				
^	16	17.39	25	28.74
—	70	76.09	59	67.82
▼	6	6.52	3	3.45
<u>Upper incisors</u>				
Vertical	19	18.27	11	11.11
Projecting slightly	80	76.92	83	83.84
Projecting markedly	5	4.81	5	5.05
<u>Bite</u>				
Under	1	.96	-	-
Edge to edge	10	9.62	10	10.10
Slight overbite	83	79.80	79	79.80
Marked overbite	10	9.62	10	10.10
<u>Number of cusps on lower second molars</u>				
Right				
4	15	19.74	13	19.12
5	61	80.26	55	80.88
Left				
4	7	9.21	6	8.00
5	69	90.79	69	92.00

by primitives is rough, bulky and resistant - qualities which tend to stimulate the masticatory apparatus to great activity and proper function. Good function contributes to good growth and healthy development of these organs. The underdeveloped jaws and poorly aligned and carious teeth of modern people are products of civilization. These conditions are not caused by faulty nutrition, as civilized people are better nourished than most of the primitives. The refined texture of the food we eat and the sophisticated methods of its preparation and consumption are the most important contributing factors in dental degeneration."

Table 25 shows that for both males and females, by far the greater percentage, usually 70 per cent or more, had slight incisor folds on the mesial and lateral incisors; no rotation of the upper mesial incisors, slightly projecting upper incisors, a slight over-bite, and 5 cusps on the left and right lower second molars.

Finally, 51 out of 130 males, or 39.2 per cent, and 55 out of 122 females, or 45.1 per cent had one or more non-erupted third molars. However, these figures include all ages, furthermore they should be used with great caution since one can only obtain an accurate picture of third molar non-eruption by the use of X-ray negatives. If one uses only those adults 28 years of age and over the results are probably more trust-worthy. In this case we have 37 out of 105 males or 35.2 per cent, and 42 out of 96 females or 43.7 per cent.

-47-  
TABLE 26

Age	Somatotype	Height (ins)	Weight (lbs)	Ht/S <sup>2</sup> /Wt	Total Dysplasia
20	154	64.0	108	13.4	10
20	154	69.0	147	13.1	18
21	253	61.5	107	12.9	22
24	163	67.5	143	12.9	10
24	253	65.0	115	13.4	20
26	253	64.0	120	13.0	24
27	254	65.8	130	13.0	14
27	453	68.0	151	12.8	22
29	262	62.5	117	12.8	18
31	452	68.0	158	12.6	12
31	162	62.5	124	12.5	12
32	145	68.3	132	13.4	8
33	352	62.3	128	12.4	16
33	145	61.8	105	13.1	16
33	154	67.8	139	13.1	28
33	253	65.0	123	13.1	14
34	254	65.5	134	12.8	20
34	263	62.5	122	12.6	20
35	252	67.5	154	12.6	22
37	353	66.8	134	13.0	26
37	154	64.5	134	12.6	18
37	253	64.0	124	12.8	18
38	352	65.0	129	12.9	10
38	451	63.5	147	12.0	24
40	362	63.8	130	12.6	16
40	262	60.5	116	12.4	22
41	353	63.3	126	12.6	34
42	253	65.3	130	12.9	14
42	352	62.0	113	12.8	38
42	252	63.3	125	12.7	16
43	245	64.8	112	13.4	22
43	252	64.5	124	12.9	14
43	253	65.8	128	13.1	16
43	442	61.5	137	11.9	22
45	253	64.5	139	12.5	20
46	253	65.0	137	12.6	12
47	252	67.3	145	12.8	12
48	154	63.3	110	13.2	18
53	253	62.0	122	12.5	34
53	253	58.8	116	12.0	14
54	154	63.0	111	13.1	12
54	252	59.5	111	12.4	18
56	261	63.5	134	12.4	16
56	452	65.3	144	12.5	18
57	253	64.8	123	13.0	16
59	253	67.8	152	12.7	20
68	352	61.0	127	12.1	18

#### CONSTITUTIONAL TYPOLOGY OF MALE PONAPE ISLANDERS

47 males between the ages of 20 and 68 years were somatotyped by the anthroposcopic (inspectional) study of the photographs of the subjects, using the five body regions and terminology of Sheldon ('40). Each component - endomorphy, mesomorphy, and ectomorphy - was rated on a seven-point scale. Only whole units were used in the somatotyping. An initial judgement of the somatotype was not made, since this may easily prejudice the rating of each region.

An experienced somatotyper has gone over several of the photographs and my results agree closely with his, therefore I believe that the 'personal equation' involved in this study is small, in terms of the final somatotype.

All the males in this sample were of the 'Pure' Ponapean type. Needless to say the sample is small, largely due to the fact that it was extremely difficult to persuade the natives to disrobe completely. Whether or not this sample is indicative of the 'normal' range of somatotypes of Ponape males it is hard to say. However, I am inclined to believe from personal observation of many males that it is.

All the somatotypes, arranged in order of age, are shown in table 26. It is interesting to note that with increase in age there is no marked increase in endomorphy. Total dysplasia ranges from 8 to 38, with 21 males falling in the 14-16 range (25.5%), and 13 males in the 18-20 range (27.7%). This shows that in using this system of somatotyping greater differences in the different regions of the body are liable to occur than when an initial judgement is made of the total somatotype and the different regions then rated. Also table 26 shows that for older age groups the index of linearity (height over the cube root of weight) is not too reliable for placing somatotypes. Furthermore it gives no indication of the amount of dysplasia.

TABLE 27. Incidence of the endomorphic component ratings.

Rating	No	%
1	10	21.3
2	25	53.2
3	7	14.9
4	5	10.6
5	0	0
6	0	0
7	0	0
	47	100.0
Mean		2.15
Standard Deviation		0.87

The distribution of component ratings are shown in tables 27, 28 and 29. In the endomorphic component the ratings are predominantly low, 53.2% have a rating of 2. The mean rating for the whole series in endomorphy is 2.15 with a standard deviation of 0.87.

TABLE 28. Incidence of the mesomorphic component ratings.

Rating	No	%
1	0	0
2	0	0
3	0	0
4	4	8.5
5	36	76.6
6	7	14.9
7	0	0
	47	100.0
Mean		5.06
Standard Deviation		0.48

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TABLE 30

Incidence of somatotypes combined into categories on the basis of component dominance (based on 7-point scale)

	No	%
<u>Endomorphic component dominant</u>		
Ectomorphy higher than mesomorphy	0	0
Mesomorphy higher than ectomorphy	0	0
Ectomorphy equals mesomorphy	<u>0</u>	<u>0</u>
<b>Totals</b>	<b>0</b>	<b>0</b>
<u>Mesomorphic component dominant</u>		
Endomorphy higher than ectomorphy	10	21.3
Ectomorphy higher than endomorphy	24	51.1
Ectomorphy equals endomorphy	<u>9</u>	<u>19.1</u>
<b>Totals</b>	<b>43</b>	<b>91.5</b>
<u>Ectomorphic component dominant</u>		
Mesomorphy higher than endomorphy	3	6.4
Endomorphy higher than mesomorphy	0	0
Mesomorphy equals endomorphy	<u>0</u>	<u>0</u>
<b>Totals</b>	<b>3</b>	<b>6.4</b>
<u>No component dominance</u>		
Endomorphy and mesomorphy equal (lower ecto)	1	2.1
Mesomorphy and ectomorphy equal (lower endo)	0	0
Endomorphy and ectomorphy equal (lower meso)	0	0
All components equal	<u>0</u>	<u>0</u>
<b>Totals</b>	<b>1</b>	<b>2.1</b>
<b>Grand totals</b>	<b>47</b>	<b>100.0</b>

In the mesomorphic component the ratings are predominantly high, 76.6% have a rating of 5, and 14.9% a rating of 6. The mean mesomorphic rating for the entire series is 5.06 with a standard deviation of 0.48.

TABLE 29. Incidence of the ectomorphic component ratings.

Rating	No	%
1	2	4.3
2	16	34.0
3	18	38.3
4	8	17.0
5	3	6.4
6	0	0
7	0	0
	47	100.0
Mean		2.87
Standard Deviation		0.96

In the ectomorphic component 34.0% have a rating of 2, 38.3% a rating of 3, and 17.0% a rating of 4. These males are thus higher in ectomorphy than endomorphy. The mean ectomorphic rating for the whole series is 2.87 with a standard deviation of 0.96.

In conclusion, the mean somatotype for the 47 males of 2.2 - 5.1 - 2.9 indicates a considerable robustness. This can be seen very clearly in table 30, where the somatotypes have been classified according to component dominance. This table shows that 91.5% of the males have higher mesomorphic than endomorphic or ectomorphic ratings. There are no dominant endomorphs. 6.4% are dominant in the ectomorphic component and only 2.1% have no component dominance. Of the dominant mesomorphs, 51.1% are higher in the ectomorphic than the endomorphic component.



Types. Ponape Islanders.



Types. Ponape Islanders.



Types. Ponape Islanders.



Types. Ponape Islanders.



NO. 3  
AGE 26  
HT 5 FT 7 1/2 IN  
WT 120



NO. 3  
AGE 26  
HT 5 FT 7 1/2 IN  
WT 120



NO. 3  
AGE 26  
HT 5 FT 7 1/2 IN  
WT 120

Somatotype 253. Age 26.



NO. 4  
AGE 33  
HT 5 FT 2 1/2 IN  
WT 120



NO. 4  
AGE 33  
HT 5 FT 2 1/2 IN  
WT 120



NO. 4  
AGE 33  
HT 5 FT 2 1/2 IN  
WT 120

Somatotype 352. Age 33.



Somatotype 3 6 2. Age 40.



Somatotype 4 5 2. Age 56.



Somatotype 352. Age 68.

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A BLOOD PRESSURE STUDY OF THE NATIVES OF PONAPE ISLAND,  
EASTERN CAROLINES

RUPERT I. MURRILL

In the summer of 1947, while making an anthropometric survey of the natives of Ponape in the Eastern Carolines, I had the opportunity at the same time of taking their blood pressure.

Ponape is a high basalt island approximately 900 miles south-east of Guam. The climate shows an annual average temperature of 80 F, humidity 86%, and rain-fall around 180 in, in short a tropical island. Ponape is about 130-145 sq. miles in size, with mountains in the interior rising to 2500 ft. Between the coast-line and the foot of the mountains the land is mostly flat, and it is here that the natives live. It is divided into 5 Districts, Sokas, Net, U, Matolenim, and Kitti. Since the main town of Colonia was destroyed by incendiary bombs and has not been rebuilt, one can say that all the natives are essentially 'rural'.

SAMPLE

I particularly want to stress the nature of the sample. The natives may be conveniently divided into 2 main types; (1) 'Pure' Ponapeans - that is to say, those whose ancestry shows no mixture with whites. (2) Mixed. These can be subdivided into; a. Ponapean natives who mixed with whites, such as Americans, English, French, Germans, and Portuguese. b. Ponapean natives who mixed with out-islanders, natives from surrounding islands. c. Ponapean natives who mixed with the Japanese. The present sample is concerned entirely with type (1). It is therefore representative of type (1) and not the total population of the island.

Actually one wonders whether the physiological phenomenon of

blood pressure is any different in the above two types as they are all living in the same environment.

Since the natives live in separate farmsteads, and one has to walk to get around, distances are too great to visit each house individually. The local District Police Chief was therefore instructed to summon the men and women to the District meeting house, from about every third or fourth home, also great stress was laid on the fact that they were not to be from the same family, this being checked in the subsequent interview. This was done in each of the 5 Districts, so one can say then that this sample was random. Furthermore, each one of the natives used was normal and healthy, this is to say none of them were hospital patients nor was a single blood pressure reading taken in a hospital.

Blood pressure readings were taken on 127 men ages 20-59, and 124 females ages 18-59. This is approximately 1/8th of the 'Pure' Ponapean population between the same ages.

#### METHOD

Before each subject was measured he or she sat at a table being interviewed in regard to their age and geneology, for at least 15 minutes. They were put at ease as much as possible. At the end of this time the blood pressure was taken. The subject's arm rested on the table at about heart level. One reading was taken by the auscultatory method always by myself and always on the right arm, using a Tycos aneroid sphygmomanometer with a 12 cm arm band. The systolic reading was taken at the appearance of the first sound and the diastolic at the change in tone.

TABLE I. 'Normal' Systolic and Diastolic Blood Pressures by Age - Males  
(Delimited Group)

Systolic Pressure mm	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	All Ages	% of Total No.
90-99	-	1	-	-	4	2	1	2	10	8.5
100-109	5	5	11	3	6	4	3	3	40	34.2
110-119	5	13	9	4	4	6	4	3	48	41.0
120-129	1	2	3	2	3	2	2	2	17	14.5
130-139	-	-	-	-	-	2	-	-	2	1.7
Total.	11	21	23	9	17	16	10	10	117	100.0
% of Total.	9.4	17.9	19.7	7.7	14.5	13.7	8.5	8.5	100.0	
Mean.	110.9	112.1	111.0	113.4	108.1	113.2	111.5	109.5	111.2	
Standard Deviation.	4.1	4.6	4.8	5.4	10.4	13.5	8.1	10.5	7.8	
Mode.	108.2	113.3	106.8	111.6	103.5	110.5	111.5	108.0	110.0	
% under 110.	45.5	28.6	47.8	33.3	58.8	37.5	40.0	50.0	42.7	
% under 120.	90.9	90.5	87.0	77.8	82.4	75.0	80.0	80.0	83.7	
Diastolic Pressure mm										
50-59	2	-	-	1	-	-	-	1	4	3.4
60-69	2	1	5	1	5	2	-	2	18	15.4
70-79	4	14	11	4	8	7	8	4	60	51.3
80-89	3	6	7	3	4	7	2	3	35	29.9
Total.	11	21	23	9	17	16	10	10	117	100.0
% of total.	9.4	17.9	19.7	7.7	14.5	13.7	8.5	8.5	110.0	
Mean.	71.8	76.9	75.4	74.5	73.9	77.6	76.5	73.5	75.3	
Standard Deviation.	11.0	2.7	5.1	8.8	5.2	4.6	1.6	8.9	5.8	
Mode.	74.8	73.6	73.9	76.9	72.4	77.6	72.6	75.0	74.7	
% under 70.	36.4	4.8	21.7	22.2	29.4	12.5	-	30.0	18.8	
% under 80.	72.7	71.4	69.6	66.7	76.5	56.3	80.0	70.0	70.1	

10 males or 7.9% excluded, with the following pressures and ages:-122/90(27),  
122/90(33), 140/90(33), 122/92(34), 132/100(37), 124/98(41), 130/92(42), 124/100(52),  
112/90(51), 112/96(56).

TABLE II 'Normal' Systolic and Diastolic Blood Pressures by Age - Females  
(Delimited Group)

Systolic Pressure mm	All Ages									% of Total No.
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-59		
80-89	-	-	1	-	-	-	-	-	1	0.9
90-99	1	-	3	3	-	2	-	1	10	9.1
100-109	2	9	10	9	7	5	4	4	50	45.5
110-119	1	-	7	8	6	5	5	3	35	31.8
120-129	1	1	2	-	3	3	2	2	14	12.7
Total	5	10	23	20	16	15	11	10	110	100.0
% of Total	4.5	9.1	20.9	18.2	14.5	13.6	10.0	9.1		100.0
Mean	108.5	106.5	107.1	107.0	112.0	110.5	112.7	110.5		109.1
Standard Deviation	10.4	3.6	8.8	4.8	5.6	9.0	5.0	8.4		7.4
Mode	102.5	100.8	105.3	106.4	108.1	109.0	110.6	106.0		105.2
% under 110	60.0	90.0	60.9	60.0	43.8	46.7	36.4	50.0		55.5
% under 120	80.0	90.0	91.3	100.0	81.3	80.0	81.8	80.0		87.3
Diastolic Pressure mm										
50-59	-	-	1	-	1	-	-	-	2	1.8
60-69	-	3	6	5	3	4	1	-	22	20.0
70-79	5	5	9	14	9	8	4	5	59	53.6
80-89	-	2	7	1	3	3	6	5	27	24.5
Total	5	10	23	20	16	15	11	10	110	100.0
% of Total	4.5	9.1	20.9	18.2	14.5	13.6	10.0	9.1		100.0
Mean	74.5	73.5	74.1	72.5	73.2	73.8	79.0	79.5		74.6
Standard Deviation	-	4.9	7.3	2.6	6.0	4.6	4.3	2.5		5.1
Mode	74.5	72.0	73.8	72.8	73.8	72.6	81.4	78.0		73.7
% under 70	-	30.0	30.4	25.0	25.0	26.7	9.1	-		21.8
% under 80	100.0	80.0	69.6	95.0	81.3	73.3	45.5	50.0		75.4

14 Females or 11.3% excluded, with the following pressures and ages:-  
124/90(21), 122/92(27), 122/98(30), 118/92(36), 122/90(40), 138/102(45), 120/100(46),  
144/102(47), 120/96(47), 116/92(49), 130/90(50), 160/90(50), 126/90(52), 144/90(56).

### RESULTS

In spite of the fact that it is claimed in recent papers<sup>1</sup> that blood pressure increases with age, especially after the age of 40, I have followed the example of Robinson and Brucer<sup>2</sup> and removed from the main sample those blood pressures of 140 systolic and over, and 90 diastolic or over. These pressures are provisionally designated as hypertensive - 'abnormal' if you will. The remainder are called 'normal' and the results are summarized in Tables I and II. Incidentally it will be noted that these Tables contain the pressures and ages of all the males and females in the total sample, a procedure often lacking in papers on blood pressure.

By this method 10 males or 7.9% of the total male sample, and 14 females or 11.3% of the total female sample have been excluded. Extremely low systolic pressures have not been discarded since none of the males and only 0.8% of the females in the total group had such pressures below 90 mm. 92.1% of all the males and 88.7% of all the females had diastolic pressures below 90 mm.

In the delimited group (Table I) for 117 males the mean systolic pressure is 111.2 mm and the standard deviation 7.8 mm. Therefore two thirds of the men have a systolic pressure between 103.4 and 119.0 mm. The mean diastolic pressure is 75.3 mm with a standard deviation of 5.8 mm giving a range of 69.5 to 81.1 mm. Use of the modal pressure has been advocated by more than one authority.<sup>3</sup> The modal systolic pressure here is 110.0 mm and the diastolic 74.7 mm.

For 110 females in the delimited group (Table II) the mean

TABLE III. Systolic and Diastolic Blood Pressures by Sex and Age of Total Group.

SYSTOLIC			DIASTOLIC		
	Male	Female		Male	Female
Pressure mm	No.	No.	Pressure mm	No.	No.
80-89	-	1	50-59	4	2
90-99	10	10	60-69	18	22
100-109	40	50	70-79	60	59
110-119	50	37	80-89	35	27
120-129	22	21	90-99	8	11
130-139	4	2	100-109	2	3
140-149	1	2			
150-159	-	-			
160-169	-	1			
Total	127	124	Total	127	124
Mean	112.4	111.5	Mean	76.9	77.1
Mode	110.3	104.9	Mode	73.9	72.0
% under 100	7.9	8.9	% under 60	3.1	1.6
% under 110	39.4	49.2	% under 70	17.3	19.4
% under 120	78.7	79.0	% under 80	64.6	66.9

systolic pressure is 109.1 mm with a standard deviation of 7.4 mm and a range of 101.7 to 117.5 mm. The mean diastolic pressure is 74.6 mm with a standard deviation of 5.1 mm thus giving a range of 69.5 to 79.7 mm. The modal systolic pressure here is 105.2 mm and the diastolic 73.7 mm. In the delimited group 83.7% of the males and 87.3% of the females have a systolic pressure below 120 mm.

For those who will have none of these delimited groups Table III has been added. In this Table none of the pressures are excluded, yet the mean systolic pressure for males is 112.4 mm, the mode 110.3 mm, with a mean diastolic pressure of 76.9 mm and mode 73.9 mm. In the females the mean systolic pressure is 111.5 mm, the mode 104.9 mm, the mean diastolic 77.1 mm and the mode 72.0 mm. There is little difference then between this group and the delimited group especially in regard to the modal pressures.

Table I shows that as many 55 year old as 20 or 30 year old men had pressures under 110 mm. However those with pressures over 120 mm show an increase with age, which is not the same thing as saying that blood pressure in general increases with age. The effect of age on blood pressure in the delimited group is shown in Fig. I.

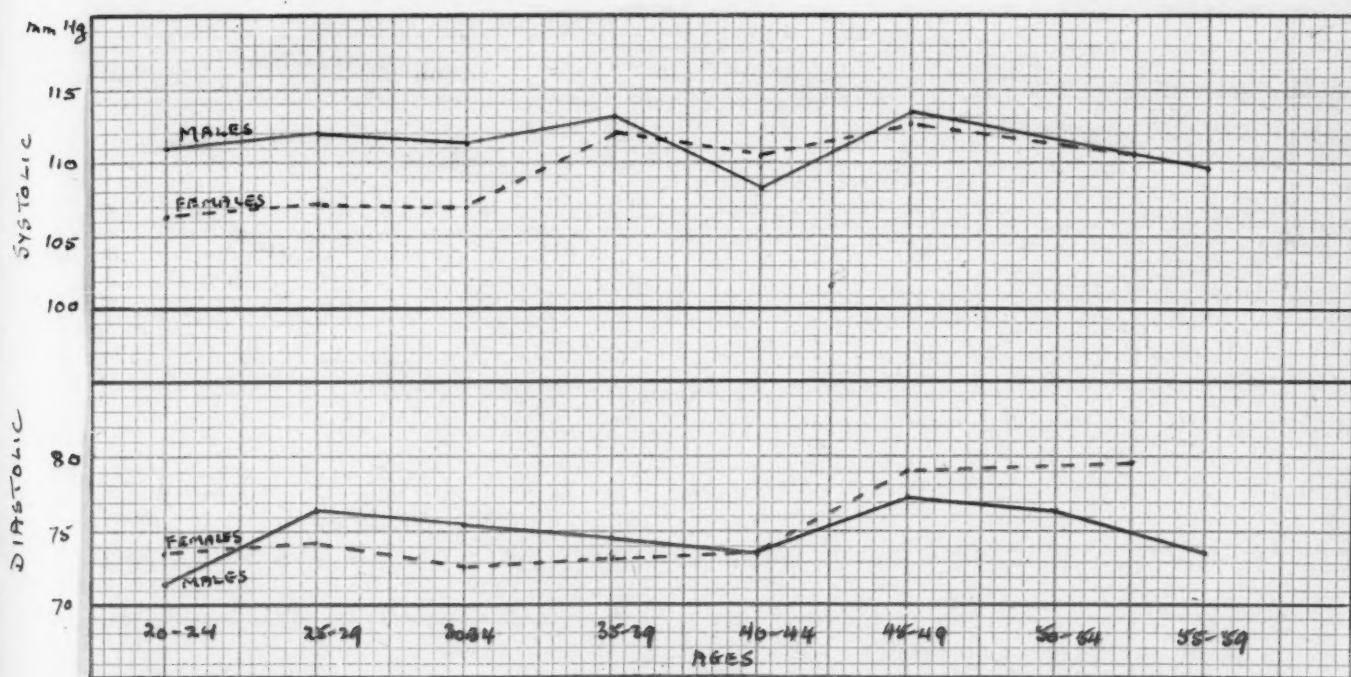


FIG. I.

This graph indicates that there is a difference in the pressures of males and females in this sample up to 40 and over 40 years of age. Up to 40 years of age the females have lower systolic and on the whole lower diastolic pressures than the males (the percentages of females with systolic pressures under 110 mm and diastolic pressures under 80 mm is greater - see Table II). After the age of 40 the systolic pressures of the males and females are similar while the diastolic pressures are somewhat higher in the females. Table IV shows that more males over 40 years of age have systolic pressures under 100 and 110 mm, while the reverse is true in the females.

TABLE IV. Systolic Blood Pressure in Males and Females  
(Delimited Group)

mm Hg	Males		Females	
	Under 40 yrs of age. %	Over 40 yrs of age. %	Under 40 yrs of age. %	Over 40 yrs of age. %
Under 100	1.6	17.0	10.8	8.2
Under 110	39.1	47.2	60.8	44.4
Under 120	87.5	79.2	90.5	80.6
Over 120	12.5	20.8	9.5	19.4

Table V, which includes all pressures in those over 40 years of age shows that as far as the mean systolic pressure is concerned, in the males it increases up to 50 years of age then decreases. In the females it increases with age throughout although the mode does not show this. The diastolic pressure in the males

increases up to 55 years of age then decreases, in the females it increases up to 50 years of age then decreases. Therefore in this sample, except for the mean systolic pressure in the females (Table V), and the female mean diastolic pressure in the delimited group (Fig. I), there is no clear-cut increase of systolic or diastolic pressure with age.

TABLE V. Systolic and Diastolic Blood Pressures by Sex and Age 40 years of age and over (Total Group)

SYSTOLIC							
Male				Female			
Age	No	Mean	Mode	Age	No	Mean	Mode
40-44	19	110.3	104.0	40-44	16	111.4	110.2
45-49	16	113.2	110.5	45-49	16	117.6	111.9
50-54	12	112.8	113.7	50-59	14	119.5	108.1
55-59	11	110.0	110.9				

DIASTOLIC							
Male				Female			
Age	No	Mean	Mode	Age	No	Mean	Mode
40-44	19	76.1	71.6	40-44	16	75.1	71.8
45-49	16	77.6	77.6	45-49	16	85.8	80.4
50-54	12	80.3	71.9	50-59	14	83.8	81.4
55-59	11	75.4	75.1				

Finally it is notable that in those males and females excluded from the delimited groups the majority were excluded because they had a high diastolic pressure rather than a high systolic pressure. This seems to agree with Huber and Russek<sup>4</sup> that the diastolic level is more indicative of hypertension.

### DISCUSSION

This paper is concerned not with hypertension but rather with so-called hypotension. Several authors<sup>5</sup> have indicated that blood pressure in the tropics is 'low' compared to American 'normal' pressure. These low systolic pressures found in the tropics range anywhere from 100 to 125 mm for males or females. If, however, we use Robinson and Brucer's 'normal' range (at least for those up to 40 years of age) of 100-125 systolic for males or females, even though their sample is by no means representative of the population of the United States, where then is the 'low' pressure ascribed to the tropics? Why any need to introduce such explanatory factors as race, diet, climate, etc?

However, as can be seen in this sample, 42.7% of the males and 55.5% of the females in the delimited group have systolic pressures under 110 mm, and it may be argued that regardless of the 'normal' range this is a high proportion of 'low' pressures.

It is admitted here that this study has certain limitations. First, only one blood pressure reading was taken per person. Second, it is estimated that 100% of the Ponape population is infested with hookworms, in addition to which a large proportion are suffering from tuberculosis (malaria is not present on Ponape). In regard to this second point one might say therefore that this sample is neither 'normal' nor 'healthy'. One immediately wonders what effect this has on the blood pressure. It is possible that this might explain the proportion of the sample with pressures below 110 mm systolic.

Donnison<sup>5</sup> reports mean systolic pressures in male negroes in Kenya, East Africa of 123.1 mm at 15-19 years of age increasing to 126.1 mm at 30-34 and thereafter decreasing to 105.8 mm at 60 years of age and over. Here we have not only blood pressure decreasing with age but also this area is one with a high incidence of schistosomiasis. One wonders again what could be the effect of such infestation on blood pressure. Saunders<sup>5</sup> reports 80% infestation of the population with ascariasis in Yucatan. The time has come to cease wondering. A study should be done, in an area having intestinal parasites, on blood pressure, using one group that is known to be free of the parasites as control, and another group that does have them.

It is claimed that when foreigners go and live in tropical countries their blood pressure drops considerably. Leaving aside their new level of blood pressure and its comparison with American 'norms', one can find a simpler explanation for this lowering of blood pressure, naive as it may sound. Most foreigners who go to live in tropical or sub-tropical countries live well compared to their former life, they usually have servants, they hurry less, in short they slow down. This lessened tension may well lower the blood pressure.

It is interesting to observe that several authors<sup>6</sup> claim a high incidence of hypertension among the negroes both in the United States and the tropics, contrary to Donnison's results. In each case we have an area where the negro is in close contact with white civilization. He may be living economically and emotionally on an inferior plane to the whites and this may well affect his

blood pressure. Saunders<sup>5</sup> states "A greater percentage of negroes in the Virgin Islands have a systolic blood pressure of more than 150 mm, and of less than 110 mm, than residents of the United States". He seems to have two groups within the negro population. It would be worth knowing which negroes (urban or rural, etc) in his sample had the high pressures.

In conclusion, and this is a main point of this paper, it should be evident by now that in all the voluminous literature on blood pressure not one sample exists that is truly representative of the normal healthy population of the United States. And yet one finds published samples, half of which contain hospital patients, or samples almost wholly consisting of urban dwellers, or insurance company samples, etc, etc, being passed off as 'representative' of the population of the United States - not to mention the rather dogmatic conclusions made from such samples concerning blood pressure. Mere numbers prove nothing. It must be obvious that blood pressures of a large number of Belgian Congo pygmies are not representative of blood pressures of all African negroes, yet this is, in essence, the technique used in the medical literature.

The medical profession is greatly concerned with diseases of the heart and its concomitant results. We now have a phrase for it, "The No. 1 Killer". Surely it is high time that blood pressures be taken on a sample that is representative of the population of the United States (in regard to sex, age, occupation, urban or rural residence, diet, etc.), and settle once and for all what is 'normal' blood pressure and whether or not blood pressure does increase with age. Such an undertaking will be expensive and

time-consuming but certainly worth-while.

SUMMARY

1. A random representative sample of 'pure' Ponapeans has been used in this study.
2. The mean systolic blood pressure for 127 males, ranging in years from 20 to 59 was found to be 112.4 mm, the diastolic pressure 76.9 mm. For 124 females, ranging in age from 18 to 59 years the mean systolic pressure was 111.5 mm, the diastolic 77.1 mm.
3. In a delimited group (excluding pressures of 140 mm systolic or over and 90 mm diastolic or over) the mean systolic pressure for 117 males was 111.2 mm, the diastolic 75.3 mm. For 110 females the mean systolic pressure was 109.1 mm, the diastolic 74.6 mm.
4. Approximately 80% in the total group and over 80% in the delimited group, of males and females, had systolic pressures below 120 mm.
5. Depending on what range one uses for 'normal' pressure it is doubted if tropical hypotension exists.
6. It is hoped that true 'representative' samples will be gathered in the future.

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